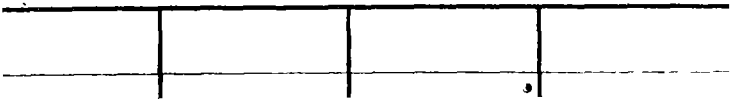

THE STATE OF PUBLIC KNOWLEDGE

by the same author

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THE DISCIPLINE OF PEACE

A HOME OF THEIR OWN

THE STATE OF PUBLIC KNOWLEDGE

by

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PREFACE

Most of us when we talk of education have little doubt that we know what it is—a process we have all passed through in earlier years. So when, as observers of parliamentary legislation, we learn that it has been decided to attempt the re-education of the nation with many more hundreds of schools and thousands of teachers, we register approval, untinged by any hint of uneasiness or hesitation. But this praiseworthy effort to bring the whole national community quickly, almost suddenly, into a better position to cope with its situation in nature and in the world of men presupposes many things. Some public critics have observed that it presupposes an amount of teaching talent of the existence of which we have no certainty. Others point out that this great expansion of schooling is to take place without educationists having shown in their scheme that they have fully thought out either what is implied in the education of the whole man or what shall be taught.

If we judge the matter by the general run of comment, however, we find that there is a fairly firm and unquestioned assumption that teachers have a sufficiency of public knowledge to impart and that fuller indoctrination thereby will benefit society.

It is possible, though this has not been much considered, that the maladjustments and inefficiencies which we seek to remedy by this extension of education, are partly derived from what happens to the personalities of men as a result of the error and imperfection in our public knowledge. If that is so, more and more of the same sort of instruction will not be a great help to us in the long run. What in this case is called for is a revaluation of knowledge itself, as well as of the part which knowledge plays in living.

In this book I do not write as an expert, or even as an inexpert, educationist. But as a doctor I have seen something of the effects of education, and what is more important, I have constantly seen men and families teased and troubled by problems of living in which their education has been no sort of help to them at all. One is sometimes provoked to ask why knowledge in the present day does so little for

men; and to answer this raises problems not easy to answer. After all, what is knowledge, how does it work, what is it for, what is it that we know, and when is knowledge reliable? These are not new questions: indeed men have been seeking the answers to them for thousands of years. But they are quite unusually urgent and critical in our day.

I have had the temerity to try to show that the conclusions to be drawn from the experience our senses give us can never amount to the sum total of the business of knowing. Here we are already deep in philosophical issues difficult to state and laborious to understand. Contemporary science has both deepened these issues and thrown new light upon them, by informing us that what the senses tell us has already been formed into patterns. This must be due to a power of integration similar, or at least closely analogous, to the integrative power of reason. If we watch the machinery of sense as science shows it to us we begin to see something of how this integrative power works. Accordingly, I have gone into some detail in describing the physiological instruments of the sense of sight.

This leads me on to the reflection that human consciousness, when, at what is called a higher plane of function, it uses words along with images, carries on this work upon an altogether different level. The process of building patterns into new and more complex ones is characteristic of the mind in all its operations, even to the building of our science and other common or public knowledge. So we get to a description of how we get our knowledge and how it is that that knowledge is communicable and verifiable.

The integrative power which has built up what we know is also active in what we are doing, as living beings, below—and perhaps very far below—the level of personal consciousness. For instance it is manifest in the tissues and organs of our body. Or again when we talk of people being teased by problems, and of their knowledge being of no help to them, we are already presupposing an integrative power which lacks knowledge and is thwarted by that lack. How this can be so is important to understand. For here is the key to our understanding of how a system of knowing, which is shared and common, is required to fertilize our culture; and how that system, if it loses connection with the vitality of life from which it originates, fails of its ultimate purpose. The power of knowledge to fertilize culture remains only so long as it does not frustrate or distort the power of life from

which it arises—a power which works in other natural beings as well as in the soul of men.

In the light of this analysis, what we know and what we do take on a new aspect; and we see how important it is to grasp the character of the knowledge we have, the way it should be used and particularly its relationship to the personalities who are in fact using it. We confront the danger of enforcing a system of knowledge which, however serviceable for some limited purposes, inhibits or distorts our apprehension of experience. Finally we are led to consider what is necessary for the good employment of the public knowledge which we have accumulated. This is a matter which can only be comprehended in the light of an understanding of the development and integration of the personality.

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INTRODUCTION

There are moments in the life of a culture when it is to be seen that a view which has long been held and acted on is now ripe to have judgment passed upon it. On such occasions the necessary imperfection of man's knowledge is thrown into relief. Discrepancies are disclosed between his recent experience of his situation and the view which led him to that experience. It is a period of review and revision. Although the old outlook no longer satisfies, it has provided, in the course of its development, new evidence sufficient to permit us to formulate a new view capable of taking its place.

Such an hour is apocalyptic. Men are aware that a world is ending. Every phase of their social living displays tension and discontinuity, and there are accordingly many levels at which the impending shift in the basis of living can be disclosed. But the welfare of man requires that his knowledge shall be sufficiently co-ordinated for the situation of mankind to be felt and understood with a certain simplicity. Not until knowledge coheres in a new and acceptable pattern is man enabled to make a new approach to the universe by and in which he lives. Culture can then bud forth into a new age.

The way in which man knows his situation has also an influence upon that situation. What he does is affected by what he thinks he can do and also by what he thinks he ought to do. His views on these points are conditioned by his knowledge of himself and his world, which, considered in the sum, is never complete and never quite accurate. But he is compelled to act as if it were both, and therefore in his management of affairs he forces his world, to the limits of its adaptability, to conform to his views. This need for an understanding on which a coherent and cultured society can act, underlies the need which man has for philosophy. We do not need to ask the philosophers how we are conveniently to arrange the affairs of to-day by the rules of yesterday: that is a matter which may be eavesdropped in any club or bar. But when the precepts of the last year, of the last century and indeed of the last age have been brought into disrepute; when the cycle of progress had revolved, and its promised land is found to be a

no-man's-land of carcasses and shell-holes; when all men know that the cathedral of the future, if it is to be built, must have its first stones laid now—then, in that present hour, there is need for man to ask from whence he has his prerogative and by what rules it may be fulfilled. To that inquiry there is no answer which will go into a sentence, nor can its urgency be met by a plan that will rest securely for all time within a well-drawn series of legislative acts. It falls to each generation to understand anew the situation of man within the universe which is his estate. When that understanding has become most obscured, the effort required to lift our eyes and to see anew where and by what authority man stands beneath the heavens is at once most necessary and most hard. Then, when we have grown unaccustomed to philosophical insight, the lack of it most depresses our counsels and leaves the depths of our resolution empty.

Knowledge in our day has become, to a degree never before experienced, knowledge of objects. This knowledge, with its essentially sensory foundations, is overweighted and overvalued. The field of knowledge has shifted to include only the atomized physical aspects of materials and their activities. Where such knowledge has been most successful, it has succeeded in eliminating the private variations of knowledge and has concentrated upon knowledge which can be shared by all—public knowledge. These two complementary facts—the predominance of the physical in knowledge and the public nature of such knowledge—have given the outer world a peculiar predominance over the inner world of man. As a result it is not easy for the inner world, in which man knows both himself and his knowledge, to reach or approach its fulfilment and thereby to demonstrate its potentialities. What is more, the principle of fulfilment or integration, although it is being constantly demonstrated throughout the whole wide realm of life on all its levels, is to-day little comprehended; for the very reason that knowledge has this bias towards the physical and towards that which is external *vis-a-vis* the self.

Knowledge of the external world is particularly well suited for treatment as public or impersonal knowledge. To understand why the very structure of our mind makes this so, is to obtain an insight into the fundamental question of what our consciousness can do.

As soon as this 'inner world' of man is studied by the same method, we find that public or impersonal knowledge of the self operates side by side with the self's private knowledge and also side by side with the

performance of the self which has its motivation beyond consciousness. Public knowledge of selfhood comes to comprehend not only that there is such a thing as private knowledge of self (consciousness) but also that there is psychical motivation beyond consciousness (the unconscious).

When these varied viewpoints and fields of knowledge have been sorted out, it becomes possible to escape from the syllogisms which have rendered philosophy so barren of recent times and to re-formulate the issue which knowledge presents to man and man to knowledge. These are large claims. Even the consideration of them requires much effort and application. As to whether they are valid, the grounds for judgment are to be found in the evidence submitted.

I

THE EVIDENCE OF PUBLIC KNOWLEDGE

Uncertainty and dissatisfaction with the philosophical precepts of the immediate past invite us not merely to reformulate our notions about our place in the universe—they also require that we should reconsider the nature of the evidence upon which these notions rest. Since man has to act upon his judgment and indeed to commit his whole culture to the consequence of taking such primary decisions as he may reach either by conviction or default, the nature of the evidence presented to his judgment is of paramount importance.

Philosophers have been universally and necessarily preoccupied with the twin problems of the nature of the evidence underlying judgement and the mind's use and management of it. When Aquinas attempted a great synthesis of the knowledge of his day, he affirmed: 'Nihil est in intellectu quod non antea fuerit in sensu'. At the peak of the philosophical era which is now drawing to its close, Kant asserted that 'without the sensuous faculty no object would be given to us' and as a corollary, that 'the understanding cannot intuit, and the sensuous faculty cannot think'. Thus, right at the beginning of this question of evidence the thinking man is called upon to give himself an account of the operative scope of the senses.

It has been customary to say that by sense, objects are given to us. Thought has been looked upon as the mind's characteristic usage of the objects so given. It has been laid down that it is by these means that we acquire the evidence which knowledge represents and upon which we act. Within this situation the special activities of science have been held to be an inquiry which brings us knowledge of the unknown. It is true that philosophers have hesitated to accept the view that the objects which science reveals are the substantia of the unknown. Kant described a gulf between the thing and the thing-in-itself—between the phenomenon and the noumenon. He did not say what degree of quality and existence his phenomenon had. But such substantiation as it could be allowed, came to it, as he asserted with axiomatic certainty, from sense and from what the mind can do to what he called the intuitions of sense.

Is there any connection between our dissatisfaction with our philosophical position and the philosophical view that knowledge is based on sense? The answer to this question can only be provided by examining the gap between knowledge and experience and noticing how well or ill experience is served by knowledge. But for this it is necessary to re-define with precision the processes and scope of knowledge which is what philosophers have been doing in various ways throughout history. If experience and experiment show that our knowledge is of a greater scope than the sensory origins of knowledge explain then obviously we are called upon to allow for and if possible to comprehend this penumbra of knowledge. The need for such an inquiry is suggested by the experience of modern psychology with its exploration of what it calls the subconscious and the Unconscious Mind.

Evidently such an inquiry is no easy matter. Not only is the inquirer walking in unfamiliar territory, he is also unable to place reliance on the traditional sign-posts. Consequently he must start from scratch and step by step he must check and verify the means which he employs to find his direction. If he is to be successful he must use means which others who come after him can employ in the same situation with the same result. And indeed any means which will meet this requirement he can usefully employ. There is moreover an obvious place for him to start. Consciousness has in its essence the quality of knowing and sense is of course the instrument of consciousness. The obvious method of approach therefore is to turn consciousness in upon itself, to ascertain what experience and experiment teach us of the field of consciousness based on sense. Then, having defined this with as much precision and care as possible, we can use the knowledge as a frame of reference and re-examine our experience in the light of it.

Such an approach is the easier in that relatively precise information has in the last three generations become available concerning the structure and function of sense. To acquire this neurological information is a tedious and difficult undertaking. However it is expounded, it remains technical and complex. It is however the essential and indispensable guide to our inquiry. By the examination of our experience in the light of this guidance it is possible to frame the philosophical issues of our day in a new and revealing manner. It is to be hoped that the reader will find the rather difficult reading of the first part

of this book justified by the insight which the developed argument gives.

In the course of the argument it is necessary to trace how individual sensory functions are woven together. This leads up to an issue to which philosophy has hitherto paid too little attention. I mean the fact that knowledge is in a large measure a common thing—a public thing. In everyday thinking we find increasingly that many minds contribute to our knowledge and that we depend almost unwittingly upon that contribution. An insight into the integration of sensory function brings some very helpful suggestions as to the way in which public knowledge is built up from the activities of many minds.

It is built up in three ways. The first is when conscious knowledge (which by definition is sensory knowledge) is obtained by a specific procedure as in science, so that the procedure can be repeated at will. The knowledge then becomes available to all who care to use the procedure or its results; it becomes public. But knowledge in this sense is like a spotlight. It can be moved and its illumination can be reinforced and extended. But what is shown up is limited, and partly determined, by the method of illumination itself. Just as the spotlight upon the hero 'picks out' and emphasizes his figure from the wide background of the unfolding drama, so our public sensory knowledge in its present imperfect state, lights up no more than a part of the darkened stage across which the march of life is proceeding.

Secondly, intruding upon public knowledge, the spontaneous, subjective drama of personal experience unfolds. This spontaneity is unpredictable and as such is unknown to public knowledge until after it has displayed itself. Yet in the moment of its emergence it requires to be illuminated by the public limelight. The public knowledge which results can then be used by the subject who is alone able to say 'I am that I am' and thus to bear private witness to his selfhood.

Thirdly, when public knowledge reviews such events as it illumines, it accumulates evidence of an unknown hinterland out of which the motivation of the self seems to spring. This, in public knowledge, we commonly speak of as the Unconscious.

II

SENSE

If we acknowledge an unknown universe beyond the barriers of sense, we may say that the pathways of sense and the traffic they carry afford us evidence of a certain sort about that universe. Such a statement as this is well enough if we know with some precision the essential points about sensory pathways and their traffic. But until we have some public and agreed information about the operations of the senses, just what we are saying and what it implies will not be clear. In the last two or three generations scientific information about sensation, which is public and agreed, has been accumulated by neurology. This information is recent, and subsequent to the great philosophical systems of the past. Those systems were in greater or less measure founded upon some scientific view of sensory function, and the views have, in certain respects, been superseded. The view of sense in which Kant in *The Critique of Pure Reason*, founded his description of our faculty of knowledge is a case in point. Kant's views of external sensation, which tells us about objects outside the self, were, by modern standards, inadequate; but his views of internal sensation, which responds to incidents within the self, were actually incorrect. Yet many of our conclusions about man's place in the universe are at present derived, either directly or more often indirectly, from the Kantian arguments. Upon these conclusions we have based many of our methods of approach to our universe, and our views of our place in it have been coloured by these methods. We are therefore called upon to review the information with which the neurologist provides us, not simply as the product of the curiosity of yet another specialism, but as a matter which affects the very heart and quality of our cultural being.

It is however by no means enough simply to stuff our mental portfolios with information which the neurological textbook affords. The analysis of the nervous system into many parts, the enumeration of these parts and the measurement of their physical properties—these procedures will not give us the answer which we are seeking. The vital question of how it is constituted is only instructive in so far as we can

set this information against an understanding of the part played by the mind in the pilgrimage of man. It is important that we should understand how each separate sense works. But this information is of itself less important to us than an understanding of the use which the mind as a whole makes of the sensorium as a whole. Nor indeed is it desirable, or for that matter possible, to understand in isolation the mind's general usage of sensation. Although analysis may tear off the limbs of knowledge for its edification, in the life of a culture knowledge has its necessary integrity, and this is to be understood only in relation to the cultural situation of man the knower.

In our search for the essential pattern of the mind's function we find that the internal architecture of the function of an individual organ such as the eye, is not only in agreement with that of other sense organs, but also with the pattern of organization which we discover in the higher levels of the mind. The characteristic fact about mental function, at whatever level we examine it, is the interweaving and interpenetration within it of the internal and the external. This fact, which is of the first philosophical consequence, is of recent recognition. The neurologist tells us that the senses are of two kinds, external and internal, the former tells about objects outside the self, the latter about incidents within. We find that to the function of such organs as the eye and the ear both internal and external senses contribute. When we pass beyond sense, and consider the function of the mind at the level of scientific investigation, we are told of the important part played in it by observational procedure. Here the scientist is called upon, not simply to observe what is external, but also to take stock of what he does. He has to allow for the observer as well as for the observed. Indeed he has found that what he does in order to observe, may affect his observed results. Thus, both in the operation of the separate organs of the mind and in those of the mind as a whole, we meet with the same interpenetration of the external and the internal. In the operation of an organ such as the eye, we are able to distinguish with some simplicity how this interpenetration is able to occur. The pattern of function which we are able to display has its relevance to that of more highly developed psychological powers.

We know that, considered as a contributor to conscious knowledge, sight is not located in the eye, any more than touch is in the skin, or taste in the tongue, or smell in the nose, or hearing in the ear. Consciousness requires the participation of the higher levels of the brain.

It is the intact brain, nourished by the living body, which is alone capable of using the organs of sense. But none the less, if sight is in question, the organ which the brain must use is the eye and the eye only. Along with this pattern of function we find a structural or anatomical pattern which is complementary to it. The antomical pattern is not restricted to the eyeball, but is dispersed throughout the brain. This notion of complementary structural and functional patterns (how it is made and how it works) as two manifestations of a single unity has to be added to that of the interpenetration of the internal and the external to enable us to glimpse the first dim outlines of sensory function. But before proceeding to a description of the anatomy of vision, it is necessary to have a sharp idea of what is meant by the neurologist when he speaks of internal and external sense. It is necessary to make this clear before returning to the eye to consider how a contribution from each type of sense is made to the function of vision.

By the term external senses we of course refer to the five senses of man with which every child is familiar; it is obvious that these are adapted to convey information to us concerning external events. What is far from us may be seen or heard; what is near to us may be felt or smelt, whilst the food which we eat is tasted. The neurologist recognizes subdivision of these senses served by paths within paths.

Our internal senses are of more recent recognition. They give the mind information concerning the disposition of, and the change within the body. Our internal senses constantly report concerning the body's balance, the pressure upon it and the detail of muscular action.

Although each sense may be looked upon as a source of information, the information only attains the form of conscious perception when the operation of our several senses is welded into unitary function. Here what we meet with is not an aggregate of sensory detail, but a field which runs together and coheres like a panorama. The first paradox which a study of the faculty of knowledge is called upon to resolve, is how our several senses are able to produce an integrated and coherent unity of knowledge at each phase of their operation. In order to approach this question we must first describe a little of the detail of our sensory make-up.

Although modern neurology presents to us a detailed picture of our senses, it would be tedious and unnecessary to describe the intricacies of the paths within the nervous system as these have been revealed by

systematic exploration with knife and microscope. The principle in each case is similar: a receptor organ, such as the retina, the cochlea of the ear or the taste buds of the tongue, is connected by nerves to the central tracts of the brain, much as the speaking end of the telephone is connected to the hearing end. But the internal senses have their receptors just as do these more familiar external senses. The semi-circular canals in the labyrinth of the ear are receptors for the sense of balance which, like other senses, has what the neurologist calls its central connections. The receptors of muscle sense, which tells us about the contraction of our muscles, are called muscle spindles. These also have central connections although they are of a special type, since some of these (which pass from the cerebellum through the red nucleus, the ansa lenticularis and optic thalamus to the cerebrum) reach the levels of consciousness while others do not (but end in the cerebellum). The receptors for the posture and passive movement[1] of joints (which are the outcome of muscular action) have central connections with the levels of consciousness. At this juncture, while we are considering the structure of our many senses, it is sufficient to recognize the essential underlying pattern whilst avoiding the confused intricacies of detail.

The study of structure does more than identify the course of specific pathways. It tells us something of their connections and interpenetration, and here we have the first clue to the problem of how diverse sensory organs are able to give us unified and coherent sensory knowledge. To take but one example: we find that the optic tracts which carry the messages relating to the effect of light on the retina are connected with the oculomotor nuclei and the paths which tell of eye movements. What is more, these are further connected (through the posterior longitudinal bundle) with the paths which convey messages concerning posture and balance. In considering this co-ordination of nerve tracts we must recall that they are used by the mind of man to bring him into urgent and immediate relationship with a world which is other than his conscious self.

We envisage energy as travelling about under the guise of light or sound until it snaps into a receiver. The receiver may be either a sense organ or a mechanical recording. In the relation of man to his unknown universe, all such physical events are conceived as external to the knower. When light falls on the retina we consider that it is not

[1] A medical phrase implying the movement of a joint by a physician or observer as distinct from active movement by the subject.

the energy which matters but the deflections in its course, which we say have happened outside us. Thus light is held to tell us not about itself, but about its relations to something other than itself. It is of something else, which we assume, that we form an image in our sensation:[1] the disturbance at the retina, which is the direct outcome of the light which falls on it, is correlated with a train of disturbances in the central nervous system. Thus at least the physicist views the situation. The anatomical structure which is here touched on in briefest outline serves to indicate how the disturbance can be propagated. Upon the foundation of this atomic physical conception we face the task of building a conception of unified and integral items of knowledge. Here we distinguish two ideas—one of pathways and the other of traffic down these pathways. We envisage a state of affairs in which the energy which makes its impact upon us has been affected in its course towards us. We do something to this energy in our sensation which allows us to know what the event is.

Let us now return to the happenings on the internal aspect of the eye as it functions as a sense organ. When the energy of light falls upon the eye, the organ is not passive towards it. The light is brought to a focus on the retina, which (along with the eye) is shifted by the muscles of the eye to receive the impression of a particular field of vision. The eye's shutter, or iris, is stopped down in response to the light's intensity, the light is bent by the lens, and the lens itself may be altered as to the angle of its convexity by an intrinsic muscle. It is a fact of primary importance that if we consider that sensation begins when energy animates the spatial limits of the body, this sensation is, from the moment of its origin, active as well as passive. Even if we consider the cellular changes of the retina, which stimulate the optic tracts, as passive[2] and essentially comparable to the action of light on a photographic emulsion (a gross over-simplification), we still have to recall the part played by the iris and the muscles which move the eye, and this part is certainly active.

But let us continue to trace out the constituent pathways of vision,

[1] Only some of what Plato called essences are capable of provoking an image in sense.

[2] i.e., caused mechanically by a sequence in which action and reaction are equal and opposite, and not by a stimulus which elicits a change of organization in the object by reason of that object's autonomy.

considering first how the purely photographic information is conveyed, and supplementing this by the part played in vision by muscular action. Of the photographic information itself, we at once come upon a significant organization. Two clearly distinguishable paths pass from the retina to the brain to convey the impression of light. Their arrangement is of great interest. The images thrown by the lens on the central part of the retina are treated differently from those thrown upon the periphery; the former are conveyed to the cerebrum (that part of it which is concerned with sight) by different pathways. There is a path of central or macular vision and an alternative path of peripheral vision. For completeness it should be added that each peripheral field is divided into two, and that images originating on the right side of the room in which I sit are carried to the left side of the brain, and those on the left side of the room to the right hemisphere.

The relationship between central and peripheral vision is relevant to the question of how the mind distinguishes a single identity from the field of vision which is presented to it.

The interplay between central and peripheral vision is not passive: it is not just that images which fall at the centre travel one path, while images that fall on the periphery travel a second. These two paths can in effect be aimed. Indeed we look to see. Attention to specific objects within the field of vision is achieved by muscular action. That is common enough knowledge, but it is not the whole story. The neurologist goes on to tell us that the brain is informed of this muscular action by internal sensation. Not only does this information make aiming possible, it also contributes to our knowledge of the location of the images which are seen. Aiming is of course effected by the ocular muscles which swivel the eyes until the path of central vision is maximally adjusted to the impulses of light and neurological sensation which pass along it.

A little consideration will serve to show that, within the function of vision as here described, we are witnessing the integration of two separate functions: pure visual sensation as traditionally understood, and muscular action as it relates the movement of the eyeballs and the function of the intrinsic muscles of the eye.

The balance and interplay of two pathways, which is characteristic of the photographic aspect of vision (pure visual sensation), proves to be equally characteristic of the movements of the eyes. There is one centre for the movement for the eye outward and another for the move-

ment of the eye inward. The pattern is further complicated by the addition of a third centre, served by the fourth cranial nerve and moving the eye down and out. Movement of the eye out is effected by the sixth cranial nerve tract, while movements inwards depend on part of the third cranial nerve. By the integration of the messages conveyed by these distinct anatomical pathways, knowledge of eye movements is built up.

Here again, the integration of the function of constituent pathways —this time all muscular—is to be recognized and emphasized.

These anatomical details do not describe to us what particular items of knowledge will constitute the interpretation which we shall put upon the particular field of vision with which our retinae, considered as receivers, will deal. They give us a public account of the field of neurological function through which that which travels the paths of energy, may be publicly considered as operating.

The pattern which is disclosed is of major significance. The functional pathways serving the unitary sense of vision are composite and not single. Not only are they multiple, but their constituents differ in kind, the sense of muscular movement being co-ordinated with that of photo-stimulation. These constituent pathways are essentially comparable to the bearings which a geometrician employs to define points and planes. Just as the bearings used by a geometrician are *integrated* into a pattern which is significant, so are the operations of the constituent pathways within a single sense, or as we shall see later, in a single act of awareness.

Such integration is a characteristic biological function which is manifested in the function of bodily organs as well as in those of the mind. The significance of such bodily function was stressed by Sir Joseph Barcroft in his book *The Architecture of Physiological Function*. Neurology now makes it evident that this same principle is characteristic of our mental as well as of our bodily function. It is characteristic of the mind to weld into unitary function the use of the constituent pathways which serve a sense organ such as the eye.

The integration which we recognize in a single sense has its parallel in the mind's integration of its many senses in the course of a single act of knowing. These senses (themselves the product of sensory nerve tracts) are in turn integrated into the unified function of perception.

If we continue to think of the universe intruding upon us and thereby appearing to us as a sequence of events, the cardinal fact about our

knowledge of such events is that our senses work together to give us several cross-bearings upon them. We not only see a flower, we may also feel and smell it. Very often, when the information which one sense conveys is in doubt, we verify it by a cross-bearing from another sense. Thus I may see a small grey object on the floor-boards and imagine it to be a dead mouse. To verify this I stoop to touch it and immediately see and recognize it as a feather. It is by the integration of the cross-bearings of sense that the pattern of knowledge is built. As the universe affects us, we build our knowledge of it and of ourselves from the primary evidence of conscious perception, but this is itself built by our awareness of how we are affected not only through our external senses, but also through our internal senses. What is more, there is constantly linkage between, and integration of the evidence which comes from these two sources. Our knowledge of the external world is in a sense knowledge of ourselves, and equally our knowledge of ourselves is in the same sense knowledge of the external world.

As we use our senses to body out our knowledge of the universe, we inform ourselves not only about things, but also about the way they are connected together in experience. If we stand aside for a moment and watch the operation of our mind we recognize two distinct phases of comprehension between which there is constant interplay. On the one hand we envisage a field of vision or a pattern of sound such as a sentence or a tune, in its entirety. On the other, we are constantly preoccupied with the task of picking out of the field some specific and coherent object and comprehending it as a thing. These two phases of the act of knowing present us with at least two major problems. The first is to describe the characteristic interplay between the two phases of the act of knowing. The second, and perhaps the more important, is to ascertain how the mind grasps the continuous phase of knowing, as the field or pattern may well be called.

We get a hint as to how we are able to pick out an object from its field from a pathological state. When an area of the retina is deficient, due to a patch of choroiditis, we can compare the situation to a fault (perhaps the size of a shilling) in a photographic film. It is quite evident that images provided by the focusing of beams of light can be cast on to the other parts of the film, whereas within the faulty area no image can be cast. In these circumstances the patient sees what he

may describe as a black object in his field of vision. It appears that he envisages the whole field of vision and is aware of the gap in it. There is much other evidence about our recognition of the total field, of which some will be instanced later. But if we accept the fact of such recognition, what the patient with choroiditis shows us is that the object may be presented to us by its contrast with its background. Indeed it is precisely this contrast between detail and background which throws the object into relief and makes it recognizable.

Here it is valuable to recall that the structure of the eye is precisely such as to render it able to pick out from the field presented to it a highly detailed centre and to emphasize the contrast between it and the field's periphery. It is evident that the function of the eye is arranged to discard from a wider background. But the eye's spotlight is mobile. It moves from point to point within the field, and the situation which it is important for us to comprehend, concerns not one point in its relation to a background, but the constant interplay between the field and the many points within it.

An analogy from the cinematograph may help us to understand this. In the making of a film the producer constantly presents his audience with two different kinds of shot—the long shot and the close-up. There are certain library shots which it is fashionable to use in the opening sequences. A view of the sky-scrapers of New York is one such long-shot. Then suddenly the interest of the audience is focused by something discrete and individual, such as a house or a doorway. And throughout the film the attention will be shuttled between a general view of the dramatic scene and a close-up of the detail. This operation is precisely what the eye and our consciousness is accustomed to. The mind also takes in the whole panorama of its field of vision and then withdraws from this to focus upon the detail of its central vision.

This outline of the relation between field and object focuses attention upon the question of how the mind recognizes the field or the continuous phase of its knowledge. When we ask the sciences of neurology and experimental psychology how man recognizes the field, context or pattern which animates his understanding of the thing, our question is of first consequence. It is intriguing to find Kant stumbling over this problem without recognizing its significance. He writes: 'If I place five points one after another . . . . . this is an image of the num-

ber five'—(*Critique of Pure Reason*). Since Kant's day Köhler[1] has asked why these five dots should represent an image of the number five—why not five images of the number one? This question is an inquiry concerning how our consciousness does in fact use our senses. The only answer which is valid in the scientific sense is the experimental answer. Only experiment can satisfactorily answer whether each unit sense impression is taken into consciousness and there built into ideas, or whether impressions are handled by groups and patterns. Are what we speak of as unit impressions just so many artefacts of our analysis? Does the very operation of sense impose an order and a pattern upon these analytic fragments? Köhler's experimental evidence answers this question conclusively. Although we can recognize unit impressions by our analytic methods, conscious sensation recognizes them not as units, but as groups. Patterns are grasped integrally, and not analytically by the summation of their constituent elements. Consciousness recognizes the pattern and it recognizes unities which are discrete within the pattern. Each such discrete unity has an identity which the principle of pattern recognition discloses. Each such identity is itself a new pattern, permitting the isolation of new units from it. The sequence of such identities, considered in isolation, is the sequence of phenomena. The *gestalt* or pattern or field is the matrix, and objects are spawned out of it, just as the close-up is from the long-shot.[2]

Hegel presented thesis, antithesis and synthesis as a description of a process of thought. But it is now to be seen that what Hegel described was a special instance of one of the general structural principles of our consciousness. This is so constituted that the interplay

[1] Wolfgang Köhler, *Gestalt Pyschology* and *Mentality of Apes*.

[2] If we were to accept for the moment the traditional sharp distinction between sense and thought, what should we then have to say concerning Köhler's evidence about pattern recognition? Although this distinction is of limited and doubtful value, it is useful to return to it to ascertain just what modification of the traditional view-point is required by the recent evidence of gestalt psychology. Is pattern recognition part of the function of sense or can it be maintained, as hitherto, that it is to be attributed to thought alone? The experimental answer is that the traditional view cannot be maintained. The recognition of patterns is displayed in the most elementary usages of our senses. Patterns, contexts and fields no less than objects travel the pathways of sense. The universe does not intrude upon us in the shape of an atomized multitude of phenomena: in the least that we can know of it there is already pattern and order.

between the identity and its context or field results in the integration or synthesis of images and ideas.

In considering the interplay between an object and its field we saw that the spotlight of the eye is mobile. This is equivalent to saying that muscular action is employed by the structure of the body to assist in the correlation of its sensory fields. We have already paid some attention to this question in our consideration of the anatomy of the senses. The facts indicate that man is not the passive recipient of knowledge of his universe, but that his actions are essential contributors to its acquisition. It is evident that knowledge is begotten not out of the simple witness of sense, but by the combination of this with muscular action. In other words, it is not only by the stimulus from the external world that we learn, but also by our response. We are not simply registers on which the external world writes itself with the help of energy; we are active participants in the world. Perception and response cannot be divided. Although, when we break up our bodies into cells, we can distinguish the purely sensory and the purely muscular cell, we cannot carry this distinction over into our everyday lives. When we use our senses it is provided by our structure that our muscles shall guide them. It is easy to multiply examples. To listen we turn the head and stand still; and in hearing, the small muscles of the ear are indispensable. To touch, we push out our fingers; to taste, we poke out the tongue, or if we are better mannered we open the mouth and discreetly close the lips upon the object; to hit the nail on the head we fix it with our touch, we measure the distance with our eye, and at the same time we are helped by our muscle sense. These are illustrations of how, in all our performances, sense is welded together with action. There is no such thing as knowledge by sense without action, because when knowledge is on the plane of sense, action is by our very constitution, integral with it.

The part played in knowledge by action is of primary importance. We distinguish beneath the pattern of consciousness a further pattern of co-ordinated neurological function in which the operations of our muscles are integrated and co-ordinated under the aegis of the cerebellum. We have seen that muscular sense (and what the eye does to light) plays an important part in the function of the eye. At the other extreme the scientist, taking stock of his observational procedure, finds that what he does may affect what he observes, and that he has therefore to keep an eye on the observer as well as on the observed.

When, with this evidence before us, we turn back to the neurologist, he recalls that the essential functional unit within the central nervous system is the reflex arc in which action and sensation, in balanced reciprocal function, are the twin constituents.

When our eyesight presents a field to our vision, there may be something in the field which strikes our attention. In order to know this something we do things to it, we explore it. The characteristic reaction of the infant is to suck it, of the child to hold it, of the boy to take it to pieces, of the scientist to measure and atomize it. In all these procedures not only are the messages of muscle sense conveyed to the brain, but also the appearances of the object, which has been isolated from the field of vision, may be altered. What can be done to a thing becomes an integral part of what is seen. Man's capacity to impose an appearance upon an event is widely exercised. Most of the furnishings of his most intimate environment are fashioned by his skill in doing. Action thus enters into our sense from two directions: first, there is the muscle sense which provides its own characteristic information; secondly, there is the ability of action to alter many of the events which stimulate the external senses. But such actions, it is to be noticed, only contribute to our knowledge of the identity which strikes the attention and which accordingly we abstract from the field. It gives us no information whatever about the field from which the identity is abstracted.

It is, however, to be seen that if we consider sensation as the food or raw material of knowledge, then, in the category of sense, we must include not only the sensory images, such as are comparable with photographic records, but also the knowledge of our own response or adjustment to these. It is from the continued integrated interplay between external stimulus and internal response (together with the observed results of our response upon the field from which the stimulus arose) that the food of knowledge is fed into the mind.

III

THOUGHT

We have seen that the relation of central to peripheral vision is one of abstraction and emphasis. The product of this relation is spoken of as the sensuous image, and at this level knowledge is immediate, certain and warm with colour. But it is discontinuous. The image is defined at the expense of its background, much or all of which we discard in order to define and emphasize the image. In this process we are limited to the particular form which experience presents to us. The precision and intimacy of the testimony of this moment are associated with the urgent intrusion of one tiny phase of the universe into our knowing. It is however also characteristic of our experience that this urgent intimacy of the moment is evanescent. Its witness constantly changes.

In spite of this flux of experience, the mind is able to retain its knowledge of the object even when the moment of knowing has passed. Memory, record and recall all contribute to this end. But as these operate, the sensuous image becomes the verbal symbol. We start with the intimate image of our sight, touch and smell, and end in the British Encyclopaedia with the frigid assertions of its definitions. It is evident that the process implies a further stage of withdrawal. It is now no longer a matter of shifting the emphasis from the field to the image. Now the image itself is emptied of its sensuous content. It is, as we say, symbolized, and we then speak of it as the object. There is, however, a most significant difference in the effect of the two processes. Whereas in picking out a sensuous image from its background, the emphasis shifts from a continuous to a discontinuous phase of knowledge; in passing from a sensuous image to its verbal symbol, precisely the opposite is true. The sensuous image is discontinuous, but the verbal symbol, the common noun, links together many images, although the linkage is not one of the sense but of reference. It is perhaps useful to cite an instance and to quote Kant for this purpose.

'The conception of a dog indicates a rule, according to which my imagination can delineate the figure of a four-footed animal in general

without being limited to any particular form which experience presents to me.'[1]

This Kant called schematization. By substitution of a verbal symbol for a sensuous image in this way, it is evident that the mind both empties its images of their content and succeeds in linking the actual with the non-actual and the recalled.

This withdrawal, from what Hegel calls sense-certainty to the symbols which thought has dislocated from the interwoven context of experience, is only a part of what requires to be taken into account in abstract thought. We have also to consider how the interpretation of images by means of verbal symbols relates these back to the sense-certainty of experience. It is true that the process of taking a close-up, of analysing 'it' out, of isolating 'it', is an essential phase of our thinking. What is more, if we leave the matter there and proceed no further, one of the realities about what we know is precisely that it is *dislocated.* This is the reason why it tends to become stale and out-of-date in relation to the immediate context of our experience, as Hegel said. But the quality of central vision—that it focuses down on certain specific features of my field of vision—always stands related to the quality of peripheral vision which brings the field into my ken; and in the operation of thought, verbal symbols allow us to relate the images of the moment to the continuity of experience. The long-shot, with its continuity and narrative, is complementary to the close-up. The close-up is as it were gathered back into the sequence which has spawned it; and, what is more, that sequence is enriched by the fact that we have seen the accent and detail of it with a sudden sharp emphasis. The close-up by itself, like the sensuous image in isolation, is meaningless. We understand it by comprehending its relationship, and here the symbol and its interweaving within the mind with other symbols, is all-important. The symbol may appear to be stale when examined in isolation, but when it is gathered back into the context from which it is torn it is clear that what had become stale is an animating factor in what is immediate and urgent in our experience. Thus as the universe intrudes upon us, the detail of its incidence may be clarified by its ability to animate symbols which had become stale in the knower's memory just as the climax of a story animates and rounds off the early details of the plot.

[1] *Critique of Pure Reason.*

In the interplay in consciousness between the image and its context on the one hand, and the verbal symbolism and the continuity of experience (implying both our view of our universe and our participation in it) on the other, we are considering another aspect of the problem of pattern recognition which we have discussed above.

In our understanding of man himself we have to look not only for his parts (his senses, his thoughts, his cognitions, his understanding, and so on) we must also at the very beginning get some sort of grasp of the pattern within which those parts cohere. To this we are led of necessity by the spontaneous processes of the mind. Already in our discussion of this matter we have seen how there is interpenetration of the external and internal; how the phases of consciousness represented by our senses are integrated into unitary function; how that function has a characteristic pattern in which there is a fluctuating coalescence of the various pathways of neurological function, according to an emphasis which shifts under the changing impacts of the universe of our experience. As our inquiry continues to move on from the physiological level to the psychological, we continue to trace out a pattern of function in which the varied processes of the mind are welded together and integrated. When the mind withdraws from the image to the symbol there is association of ideas between symbols. But this withdrawal is only one phase. The next phase of function is the re-integration of symbols with sensuous images. Such building of symbols into experience enriches its depth and quality.

The mind's eye can see more than that of the body. Fields which cannot be put together by sense are none the less created by the operations of thought. We cannot embrace the country in which we live within the field of our five senses, but we can none the less envisage its existence. Consciousness not only abstracts the symbol from the patterns presented by sense, it also runs together new patterns by the integration of these symbols.

It cannot be too strongly emphasized, that in no sense is the correlation and continuity of the knowledge which our use of symbol affords us, a description of the correlation and continuity of the universe which intrudes through our experience. Although the running together of symbols and the creation of a continuous phase of knowledge by this means, stand in a very special complementary relation-

ship to the continuity of experience, they neither are nor can be a description of the universe.

How then, shall we define knowledge, or think of it? At a first approximation, the interplay between man, his knowledge and his universe, may be described in terms of a frame of reference, which stands between man and what he attempts to know and is used by him in his performance to elaborate his relationship with this universe. This concept is one of the keys to an adequate understanding of how and to what end we know.

This notion of a frame of reference features largely in the later pages of this book, and it will be helpful if the reader carries with him a precise understanding of what that phrase implies. A sensory image usually implies a knower and something separate from knower and image which as we say 'causes' the image. There is thus a threefold relationship between mind, image and object. Now if we talk about the same situation in different language we can say that the knower (the mind) uses a frame of reference (the image) to refer to the referent (the object). We have already seen that the image may give way to the symbol as the conscious mind responds (or refers) to its experience of the universe. We have also noticed that this process of knowing can refer not only to the external world of objects, but also to the inner world of man. For these reasons it is useful to be able to refer to the intermediary between the knower and the known—whether this be image or symbol or idea or association of ideas or any other integrated standard which serves the process of reference. As a name for this general intermediary the phrase 'frame of reference' serves very well.

The mind of man has not only to be understood in the moments of its insight into detail. Its dignity and its power reside in the integrity into which it can and does weave the many moments of its being. Just as the moment of knowledge is built out of the function of constituent nerve tracts, so the quality of the mind arises from the interweaving of knowledge with behaviour which brings knowledge to the proof by performance.

To begin to comprehend thought we must envisage the detailed operations of the mind against the generality of our understanding. The mind is but part of a situation which includes man the knower and the universe which he knows. We have already seen that each

moment of sense perception has its own specific quality. Over against this must be set the association of ideas which results from a common set of verbal symbols and a common language. This means that there is a tendency in the individual mind to see what is specific in the light of what is, up to a certain point, standard. On the other hand, the specificity of sensory experience makes it possible for the individual to diversify the standards which he uses by employing them in a different way with new interpretations and combinations. What is more, any new combination or association of ideas can be brought into play as a symbol for the re-interpretation of experience.

In all this we are dealing with what may be described as another dimension of the mind. This results from the fact that man, like other living things, has a characteristic development. Memory is one aspect of the product of such development. Evidently, without the power to recall into consciousness and to associate what is so recalled, no development of knowledge would be possible. In experience, the fact of man's life history appears to him in the guise of what philosophers since Bergson have referred to as his duration.

The continuity of man's duration is one of the essential features of his mental make-up. When day by day he uses his senses to know the objects which they present to him, the constant factor in his observation is himself. This very obvious statement deserves a little consideration. If we think of sense perception as a system of bearings used to define an object, it is evident that the only fixed and given point which is common to every occasion into which sense perception enters, is myself. I thus know myself in a way which is different from that in which I know my chair. This is true because whether it is an image or a proposition which I consider, I am present as the observer. All the cross-bearings of my thought are not only taken in myself; they are also integrated, if at all, in myself. The system of cross-bearings which relates to myself thus has a different structure to that of the bearings relating to any other object. It is the continuity of this successive relating to myself which, subject to the question of intensity of experience, is the basis of an understanding of time in the sense of duration.

With this question of personal duration is associated a philosophical conundrum of some consequence. It concerns how the individual knower can be known. Kant invented a special internal sense for the purpose, but science has never been able to demonstrate it. This in-

vention made it possible for the individual to know his own internal state by this special faculty. But obviously he could not know his neighbour as he knew himself. His neighbour was phenomenal. Thus Kant's knowledge of himself was different in kind from his knowledge of his neighbour. We find that this point of view led Kant to imply a synthetic super-observer.

In the light of the evidence of neurology and experimental psychology quite a different statement must be made. Our internal senses do not give us any direct evidence about our mental state. They tell us about such things as our balance, posture and muscular co-ordination. There is no difference in kind between their method of reporting their information and that employed by our external senses. I know about the contraction of my muscles by sense and I know equally about the chair I sit on by sense. If I wish, I can usually verify each sensation by a cross-bearing from another sense. If there are difficulties in saying what we know from the information of our internal senses, the difficulty is of the same kind as that which we experience in describing what we know from our external senses. In each case there is a gap between sense stimulation and the resultant knowledge. Consciousness uses the information of sense to feed the conscious mind. The question as to how the individual knower knows himself, in so far as it relates to how his knowledge of himself is fed by sense, is, with one significant difference, the same as the question of how he knows things. This difference has already been noted. Whereas in every different act of knowing, all the other constituents are different, the knower is the constant constituent, always one and the same.

The question of how I know myself leads on to the issue which is presented by the minds of our neighbours. Since the beginning of verbal communication, what was said to a man by his neighbour has obviously been of considerable importance both in the sum of his knowledge and in his behaviour. We have already seen that the bringing of sensuous imagery into the compass of standard verbal symbols is a matter of great consequence in the elaboration of knowledge. To-day the rapid development of science, with its rigid definitions and its specialized procedures, has extended that part of a man's knowledge which he has in common with his neighbour as never before. Any account of knowledge to-day must explain how this inter-communication is possible.

Man's life history has its record within his consciousness by memory. It is on this plane of experience that knowledge is born. Its character is already to be seen in the first achievements of the infant. The elaboration of this primitive pattern in its interplay with public knowledge is the basis of man's educability.

The structure of consciousness, in all extra-uterine life, is given as a premise, so that as soon as we can know the mind, it is already an organization in which the integration of muscular and sensory function is taking place. The five senses co-operate with muscle balance to give the infant its first private view of the world, uninfluenced by the communications and inquiries of speech. But it is evident that the child has something over—that there is already a person and a mentality which uses the interplay of sense and action. It is in this relation between the function of the moment and the integrity of the person (who builds into one experience the succession of his many moments) that what the philosophers have spoken of as Meaning arises. The beginnings of this can be distinguished in the child before verbal symbols are systematically comprehended or employed. With the development of speech the public contribution to its thought gradually comes to have an increasing influence and significance. In all this, sensation is not so much the raw material out of which consciousness is fabricated as the food by which consciousness, which is a process of consistent development, is fed.

Like the body, consciousness requires adequate feeding for the maintenance of its functions. At the same time nothing can be predicted about this function. We cannot predict the nature of the human circulation from the study of bread or food; to know the circulation, we have to study it by the methods of observational procedure. But it is to be noted that I do not need to know my circulation before the heart and blood-vessels of my body can work. The structure and function of the body is there first, and knowledge comes afterwards. In the same way, to know the function of consciousness we also must proceed by means of observational procedure, but whether we in fact acquire any knowledge of this function or not we are and will remain conscious.

When we speak of observational procedure, we refer to that combination of activity and sensation which we have seen to be the characteristic of conscious mental function. In scientific inquiry such observational procedure follows a public and agreed method.

In the beginnings of private thinking consciousness is fed exclusively by the operations of the individual's sensation. Whatever degree of consciousness may be present in the early days of infancy, behaviour is seen to be built upon the coalescence and integration of sensation with action. The first communications of the child are nominative; they express the recognition of identities. As soon as the child begins to talk and to understand he begins to learn not only from his own sensations but from others. He is encouraged to give names to things by his elders whom he imitates. In this way the child is encouraged to build up his own usage of symbols. This is an achievement which his inherent capacities make possible. But equally the development of those capacities depends on the presence of his neighbours and in particular of his family. With his recognition and naming of entities the child is already making use of verbal symbols which are frames of reference for experience just as much as the symbols and standards of science. It is true that science is more precise and careful in its classification than is the child, but in its primitive way the child already displays that usage of symbols which is typical of public knowledge. Such a symbol, it must be repeated, is a standard in so far as differing moments of experience can have their characters referred to and subsumed under it. It is only by this means, by use, that is, of the standard frames of public reference, that intercommunication, which makes public knowledge practicable, can be effected.

The processes of integration which are evident in the intellectual make-up of the individual have their parallel when an individual's knowledge is integrated with the knowledge of his neighbour. We have seen that, in the integration of the cross-bearings provided by our individual senses, we demand consistent evidence from our diverse sources of information. We use our various sensations to verify our judgments, as when we discover what appears to be a mouse to be a feather by touching it. When we pass from judgments founded on our own sensations, to judgments founded on symbols, we apply the same process. Here the evidence of our neighbours becomes relevant. I can to some extent share in and use the information which is acquired by the senses of my neighbours. I may, for example, have a friend who visits Mexico and takes with him a cine-camera. On his return he can not only tell me about what he has seen and experienced, he can produce an abstract from his visual sensations which I can study. There is of course a very real difference between the informa-

tion which I should get from my own senses during a stay in Mexico and that which is available to me from the narratives of travellers and the records of the cinema and books, and it is a difference between the image and the symbol. But it is to be recognized that beyond all question, sense information which is not the direct product of my own faculties is an important contribution to both my knowledge and my behaviour.

In judging the evidence of others we tend to accept readily that which conforms to our own experience whilst we suspect that which is strange. Judgments founded upon our own senses constitute a bearing which we use consistently and with confidence. The integrative thought processes thus operate upon a similar if less certain pattern both in the case of our own sensations and where we depend for our knowledge upon our neighbour's sensations and judgments. The differentiation and elaboration of this interplay between image and symbol among many minds is the root and branch of our scientific civilization. It develops on the one hand into the intricacies of observational procedure, and complementary to this it produces the public frame of reference.

Whereas in individual thought a single sense will give a bearing, in public thought it is commonly a complex of sense and action, spoken of as observational procedure, which does so. With this development we leave the realm of spontaneous process and enter that of method. Involuntary integration gives place to voluntary integration, and with this step the probability of error increases. Compare two examples of integration. The first is an example of spontaneous personal judgment. Suppose I am returning to my home town by train. I have been sitting in the carriage reading. I look up and see at a glance that we are just running into the station of the town where I live. Automatically I close my book, collect my hat from the luggage rack and prepare to alight. In all this, the integration of my sense-action mechanism has been spontaneous, sudden and certain. The operation of the single sense of sight is the main 'bearing' upon which a judgment is reached and from which the associated behaviour pattern springs.

Contrast with this the way in which I judge when later, during a holiday, I arrive in Florence for the first time with a Baedeker. I want to find my hotel and, unless I prefer to ask a porter, I must open the

book and refer to its description and its maps. In either case I must do something first in order that I may later be able to bring my senses into operation. What is more, my senses do not at first operate directly upon my hotel. What I use to begin with is a plan or a verbal symbol which is a 'bearing' upon my hotel and it is by action, walking or arranging transport under the guidance of my directions, that I integrate my knowledge and action until the moment when I can say, 'Ah! here it is!' In using the Baedeker plan I should probably be hesitant and refer back to it constantly: with the unfamiliar it is usual to be slow. Each particular bearing which I follow—(down that street, turn to the left, etc.) includes an integration of sense and action in every way as complete as that which forms the basis of my judgment when I recognize that my train has reached its destination, but each such bearing has to be integrated anew into the total procedure of finding my way through a city by a plan. It is to be noticed that in the more elementary procedure, knowledge runs together and coalesces on its own. In the more elaborately integrated procedure, the various constituent procedures have to be put together rather laboriously so that the integration is less certain and leaves more room for error; but the process of integration by which knowledge is built is in each case essentially comparable.

There is, however, yet a further stage to be considered. Suppose now that having explored Florence in its detail and memorized my Baedeker, I end up by becoming a Cook's guide. I still have occasion to find my way from the station to the hotel in question. But this has now become second nature, my direction finding has become automatic. The integration of the cross-bearings on which I work has become greatly facilitated.

At this juncture the reader may well object that he was given to understand that he was to consider not active behaviour but knowledge. Such objections may easily be met by replacing our traveller by a student of physiology. This youngster is engaged in learning about the function of the lungs. He breathes into a Douglas bag, records certain measurements, and estimates certain gases. The co-ordination of sense and action and the integration of many simple procedures into the greater procedure of the experiment are here all distinguishable. No doubt the youngster would have to become a demonstrator for his procedure to become facilitated, and it is doubtful if he would ever be so slick at his tricks as the guide would be at

his. But the parallel is certainly there. If, as is usual, physiology is disregarded, consider mathematics, the science which Kant took as the type *par excellence* of *a priori* thought. Here my point can be demonstrated in Kant's own words.

'We cannot cogitate a geometrical line without *drawing* it in thought nor a circle without *describing* it (Kant's italics), nor represent the three dimensions of space without drawing three lines from the same perpendicular to one another.'[1]

These instances of observational procedure have been cited from more general examples, so that it may be shown that science, with its specialized procedure, represents no more than a special instance of a general mode of thought. It is evident that here verbal symbols are correlated and integrated with sense and action, so that the whole person moves into contact with a phase of his experience. It is evident that the procedure, such as looking at the map, recovers its significance by its use, which brings the person back into contact with events. One is reminded of the function of the verbal symbol when, in an earlier and less elaborate phase of mental function, it also recovered its significance by re-integration into the flux of experience.

While on this subject of observational procedure it is perhaps useful to complete our account with an instance taken from the special case of science. Let us suppose that a biologist is inquiring into the cellular organization of the liver. He fixes the liver and then proceeds to cut it into a series of fine sections. He may, if he is sufficiently diligent, bring the whole length and breadth of the organ into the perspective of his understanding by this procedure of serial sections. However, when he has finished his laborious task of preparing his sections, he cannot just look at them and thereby see in a flash what the structure and function of the liver is. On the contrary, his sections are like a single piece of a map. They are but a contributry factor in his knowledge. Their integration in the public science of physiology requires the mediation of many conscious minds, who use these sections as a single bearing in a method which enables them to give an approximate account of liver function.

It is worth while pausing to consider what is implied in the process of tissue fixation which is a preliminary of microscopical procedure. To fix a tissue implies dislocating it from its physiological pattern. We abstract the tissue and stop it changing. Of course, when we do

[1] *Critique of Pure Reason*. p. 106.

this to anything living we kill it in the process. Thus by the processes of abstraction and manipulation we alter what is presented to the field of vision which the microscope affords. It is true that it is just possible to manipulate certain cells in tissue culture so that they can be seen under a microscope in the living state, but this is not true of the cells which constitute an adult physiology. All that this can be said to do, therefore, is to provide an alternative bearing which we can integrate in the public process of reference, just as we integrate the bearing provided by our sections. When, by fixation, we abstract a cross section of an organ which can be used as a bearing in the task of trying to comprehend that organ's function the knowledge of the organ which we thereby acquire is discontinuous—it is an isolated fact comparable to an unintegrated sensation. We have chipped a piece out of the living process and killed it by doing so. But this inert abstraction can again be taken up by the continuous phase of an individual consciousness and be interpreted by its integration with other bearings. The understanding thus acquired can be communicated by the individual to his colleagues, and the actions of many sections of the community may be affected by the communication.

Let us now consider an instance of what it is that observational procedure produces. Public clock time affords a typical instance of a public frame of reference. Think of how we tell the time. Perhaps the best instance is afforded by the ship's officer who reads the heavens in the best tradition of the ancient astronomers. He calculates the time and reports to the captain, whose traditional order is, 'Make it so'. The Astronomer Royal at Greenwich makes his own brand of Greenwich mean time. The clockmaker makes his clocks, and the public follows the example of the captain on the bridge; when they hear the time signal they 'make it so', they put their clocks right. By these actions we acquire a frame of reference which we can understand as related to the succession of the cross-bearings of our knowledge. What I do when I provide myself with a mechanical time recorder is to make it possible to relate events in a system of succession which is other than my own private system of duration. The instruments I provide myself with and the procedure which I follow allow me to know things in relation to public clock time.

Clock time well illustrates how sensations which our actions have made possible may in turn affect our behaviour. It is said that the

first general introduction of clock time into society came when the monastery bell began to toll the hours. This was meant to remind man of the term of his days and the certainty of death. But in practice it was the introduction of a standard, a point of reference which the people of the village had in common.

It is impossible to understand clock time in terms of a solitary or a synthetic mind. Any public system implies several people. Each individual has a specific personal duration, and the purpose of clock time is to relate the variations of personal experience to a common central system of succession. Every one of my neighbours can, by this procedure, relate his specific personal duration to the *same* system of time succession as I do; and what is more, I, like them, can take a bearing on identities of which my senses give me information. In clock time it is to be recognized that the relation of personal durations to the public frame of reference which clock time represents, is something which has to be *done*. The greater the number of persons who enter the relationship, the more complicated the problem of making the frame of reference, because apparently the structure of our system of cross-bearings is affected, when groups of people are widely separated, by the structure of the planetary system. The public inquiry called physics has gone into this matter very thoroughly since the days of Kant.

What that standard has done is evident when we come to consider contemporary social organization. Consider, for example, the production belt of a factory where a team of men are employed to assemble some article which is mass produced. The factory hooter warns them of the time to start work. They clock in. The succession of their various jobs is timed, and the time taken for each process is carefully recorded. It may be objected that the time sheet of a factory has little relation to the question of knowledge, but this is a superficial view. What we know is integrated with what we do in the intimate obscurities of the function of our senses, and analagous integration persists throughout the whole structure of our society.

Clock time is only one example of a public frame of reference. Our standards for weights and measures, and our units of energy, are likewise fabricated by our public thinking and at the root of each of them we find a definition, a unit imposed by common consent. It is by the consistent use of this conventional definition that the public frame of scientific reference is elaborated and rendered useful.

Having illustrated what is meant by observational procedure and frames of reference, it remains for us to inquire concerning their usage. We must recall the situation of man as a participant in a universe which is presented to him through his experience. We must remember that man himself is putting up a performance which contributes to his experience. To keep his bearings in all this and to keep in step with his neighbours, he not only takes his bearings on events in his experience by sense and observational procedure, but he also correlates this testimony both with his individual memory and social records.

The chief thing which must be said of his frames of reference is that they are the measure of his expectation. Whether we take a map of a town or an anatomical chart of an organ or organism, man's expectation is that the limited statement (relating to structure as distinct from the workings and history of that structure) contained in this frame of reference will correspond with his observations on structure if he uses the proper procedure to repeat them. Furthermore, if he acts as if the statement of the map is correct, he expects that his actions (as in going to a specified street) will be effective.

Frames of reference are not limited in their application to statements about structure. The more complex statements about function or performance and about history and development, are also within their scope. Man's experience shows that knowledge of the functioning of the identities which his experience presents (and still more of the total field or context of those identities) is more difficult to come by and more complex than knowledge of structure. In accordance with this, frames of reference relating to function take on a parallel complexity. The use of frames of reference in the study of function and performance requires separate consideration. But before turning our attention to this matter we shall have to discuss the important part played in scientific frames of reference by atomic analysis.

The first point then about a frame of reference is the classification of the objects to be studied. This obviously is the stage of withdrawal from sensuous image to verbal symbol. If necessary, verbal symbols will be invented to name the images which our experience presents.

Next, the objects of knowledge are subjected to common observation and observational procedure to ascertain their characteristic structure and performance. Structure is shown by displaying its con-

stituent parts. Function often presents a more difficult problem. The aim of our frame of reference is to represent the character and behaviour of what we are studying as we encounter it in our experience, and produce a standard account of the matter.

Once this has been constructed, we base our expectations upon it. The more satisfactory its construction the more completely our experience fulfils our expectation.

In practice we find that our most successful specialized frames of reference are those of the most general application. In physics, for example, it is the notions of the centimetre, the gramme and the second; of work, heat, energy, power—which are the bases of our frameworks and which not only serve in relation to many groups of objects, but also are inter-related among themselves.

It might be supposed that these very general conceptions would be the product of the continuous phase of our knowledge. But this is not the case. The success of the frame of reference results in the first place from the complete artificiality of its units, and in the second place from bringing wellnigh the whole individual range of our experience into relation with these mental concepts. I use the word 'artificiality' in the sense of being devised by artifice. The standard units of the elementary properties of material things are set up by definition. It is again a case of 'make it so'. But the crux of the matter is twofold. In the first place it is a standard and a public standard. In the second place it is an atomic standard; therefore it is capable of synthesis by the simple processes of arithmetic.

The significance of atomism begins to appear when we pass from the centimetre, gramme and second to the erg, the calorie, the joule and the watt. The physicist tells us that one joule equals 10^7 ergs; that Joule's equivalent relates the calorie to the watt by a simple formula, and so on and so on. In all this we meet with a unit of atomic character by which what is in fact the behaviour of materials can be described. The behaviour in question is not simply the situation of the materials in what may be called their natural state; it is also a description of what can be done to them by man. Indeed it is in man's manipulation of materials that these frames of reference have their major application. And the units quoted are but instances of a method of thought which has undergone immense development, reaching perhaps its culmination in Planck's quantum theory, which is able, for example, to describe a wave form such as light by an atomic measure

which connects its frequency with its wave length. The interesting thing about this sort of atomic analysis is the imposition of a discontinuous system upon an apparently continuous field. Obviously the process bears no direct relationship to the machinery of sense perception, but the analogy with the sense recognition of units is clearly to be seen, and the usefulness of the method in effecting manipulative *ad hoc* actions is very great indeed.

When a frame of reference includes a statement relating to the function and workings of a particular biological structure, two questions are raised. How is a frame of reference capable of such statement arrived at? Second: is the frame of reference able to give our experience an adequate bearing (i.e. a point of view on which we can act) upon the function which we are studying?

The mode of construction of frames of reference shows that it is possible to create two or more different frameworks referring to the same field of objects and for those frameworks to be inconsistent. Indeed this is a common experience in science, giving rise, it may be, to two or more schools of thought. This may be because the frameworks are incompletely or incorrectly drawn, or because their derivation from experience is inadequate.

We have seen how in the use of speech we withdraw from the specific imagery of sense to the verbal symbol, which by reason of its public character tends to standardization and so blurs the detail and empties the content of the specific event. This is equivalent to the substitution of a static statement for a process which has duration and (it may be) life. The analytic process is one of fixation. The effects of such a process will obviously depend on whether what it operates upon is fixed or moving. Even with the moving thing it will depend on whether what moves is constant or changes: the critical instances of this being the change from life to death in the fixation of tissues and the change from one state to another with time (the caterpillar turning into butterfly, and so on). Special frames of reference have been devised by the scientist to describe the rate of change of motion in inorganic systems. The differential calculus is of this character. We have, however, no comparable system of notation for change within an organic system. The cinematograph has a limited use in showing a succession of states. But for the most part the biological scientist must bridge the gap between his fixed specimen and the living function by

his own integrative capacity. But it is not simply in the matter of specimens that this applies. His ideas are always in a sense the product of fixation since they have the quality of verbal symbols. His situation is more disadvantageous than that of a man with a two-dimensional chart of a three-dimensional structure in motion. But above all it is to be noticed that although his notations are adapted to describe the product of his analysis and in general to deal with the discontinuous phases of knowledge he has at his disposal no notation adapted to describe integration or the continuous phase of knowledge beyond the everyday verbal symbolism of language.

The complexity of our frames of reference is evident when it is considered that we are everywhere seeking not only the classification of identities, but also their characteristic structure and performance in relation to the field and universe in which they occur. Our consciousness requires that we know identities not only discontinuously as isolated objects of inquiry, but also continuously as participants in the great totality towards which the natural coalescence of our knowledge is orientated. In other words, the process of integration which begets the patterns of our individual frames of reference and consequent life-style applies equally to our public frames of reference and politico-social procedure. Thus the problem of their further integration is always a very real and present factor in our problem of knowledge.

IV

CAUSATION

Frames of reference, then, as we have seen, may be conceived as systems of fixed points to which we refer the spontaneity of events, and their primary value is that they allow us to act in relation to the events. One method which is commonly used to find our way about these charts is causality. We note the succession of events and as we study the succession, whether of the atomized fragments of the field or of the field itself, we ascertain that there are certain consistencies within our frame of reference. Hume, who considered an atomized field, distinguished this consistency from succession, and spoke of it as necessity. He found this necessity incomprehensible, and within a field viewed under the predilections of atomic analysis this necessity is and must be incomprehensible. But the pattern of the field can and does show us how certain successions must fall. Both the logical order which we establish within our own knowledge, and the order which we glimpse in the universe, as it intrudes into our experience, are to be understood as fields which imply a certain necessity in succession. The structure and performance of the frame of reference are easier to understand than those of the referent. The latter we only partly understand through our chart, which, constituted from certain bearings which we take on it, is, as it were, only the blackboard on which we record the spontaneity of that to which it refers. None the less, the structure and order of the referent finds partial representation in the frame of reference by which we attempt to build up our public knowledge of it.

Let us attempt to illustrate this. If I get a blow on the side of my head and as a result my left hand and leg are paralysed, we say that the paralysis is caused by the blow, of which it is the effect. Now mechanically the blow is quite insufficient to affect the foot. We are thus at first sight presented with what appears to be action at a distance. But this we do not accept. Our rejection of the idea is justified by the discovery of an anatomical structure within the body, such that the muscular actions of the left limbs are facilitated by nerve tracts running from the right side of the head. The blow itself is un-

predictable by the notion of structure which underlies our interpretation of its effect. But if the result of the blow is damage of these nerve tracts at the site of origin this necessarily leads to disability in the related limb. We thus see that certain successions run together. Damage to the nerve cells of the cortex has a necessary sequence. The blow however lies in no necessary sequence. It happens, as we say, by accident, and the result is uncertain.

We should guard against the assumption that we have a sharp and invariable understanding of the meaning of causality. Aristotle distinguished several types. For Hume, causality was in essence succession, and in so far as he allowed that a certain necessity was recognizable in successions of cause, he affirmed, as I have said, that this necessity passed all understanding. But perhaps the sharpest alteration in the interpretation of the meaning of cause took place with the exposition of the second law of thermo-dynamics. In the brilliant original exposition of this law,[1] it was affirmed that cause was equal to effect. This definition was an imperative put in to meet the requirements of an advancing physical science. It was a new way of saying which successions were to be selected and studied. In spite of this, the general practice in discussions of causality does not treat the cause as if it equalled the effect.

It is most important to grasp clearly the epistemological situation which underlies these variations in the cause. The frames of thought, about which we try to find our way by the study of causality, comprise either a pattern of structure and function such as that of the body, or a completely atomized field such as that of energy. Let us consider the latter first. When a student is engaged in the study of physics he finds that as he comes to each particular phase of energy, such as light, heat, mechanical work or electric current, a unit such as a candle power, a calorie, an erg or watt is arbitrarily established within the field. These are the atomic units to which the conventions of analytical thought and logic reduce the field of study. It is because these units are made equal (a calorie is always by definition a calorie and an erg an erg) that in studying succession the erg which precedes is always equal to the erg which follows. If the energy of the first unit is regarded as the cause of the energy in the succeeding unit, obviously this cause is equal to the effect. What is more, since science has established by experiment and definition the equivalence between its

[1] By Carnot and Clausius.

varied units, it is evident that we can pass from calories to watts and still display the equality of the cause and its effect.

When we come to study the use of causality in keeping track of our charts of function, the situation is very different. Let us take an example. We say that on a diet of 4,000 calories a man is able to do a hard day's work. This statement gives us an angle on human activity. Work, curiously enough, is for the physicist a form of energy which has a defined unit, the erg. There is a sense therefore in which we can speak of 4,000 calories (a diet) as the cause of so many ergs (the day's work of a labourer). This is the atomic approach. In practice we find that the details of the energetic field are excessively complex. For example, a labourer can on occasion produce his characteristic day's work without having any diet at all. The explanation of this is that the interval between the diet and the output of work is occupied by a large amount of stored reserve energy, and for a time it is possible to produce work from these reserves instead of from the inflow of energy (diet). However, it is possible by appropriate procedure to measure the intake of energy and the output, and thus to continue with our studies of energy by maintaining our atomic analysis. In all this the measurements of energy are devised to provide a public frame of reference of bodily activity. But this atomic frame of reference is only one among many that are possible. The student of physiology is less interested in the actual flow of energy and more interested in its transformation by the structure and function of the body. To comprehend these he invents in due turn his own frames of reference. Each frame provides a bearing on an integral performance, and to render our knowledge less partial we integrate the information of these varied frames.

It is evident that, when a pattern of structure and performance, such as the field of physiology, is subjected to atomic analysis—as by definition it is if it is studied in terms of energy—the organization displayed by the fragments will be less than that displayed by the original pattern. This is epistemologically obvious. In the case of the statement which is the substance of the second law of thermo-dynamics, Eddington's disclosure, that the law is subjective and epistemological, and is not an assertion about the universe, is a reminder that we have to employ the continuous phase of knowledge in our attempts to comprehend the universe, and that we cannot attain this end by atomism and synthesis. This experience of the physicist is a most

damning comment upon Kant's philosophical system, which proceeds from the atomism of sense to the synthesis of the resulting atomic intuitions by reason.

In order to understand the place of causality in the consideration of structure and performance, it may be helpful to consider certain characteristics of the development of a typical frame of reference. There is always an interplay between our frame of reference, its referent and our own performance. A diet of 4,000 calories is a public frame of reference. It is not only something which we know, in the sense that we can specify constituents for it; it is also something which we can do, in the sense that we can feed these constituents to an actual working man. When we proceed to do this, we affect the working man. We find that by treating him purely and simply as an interval in a measured energetic flow, we endanger his structure and his performance. This leads us to review our frame of reference, in the attempt to get a bearing not only on the energetic flow, but also upon the structure which allows the flow to continue and to emerge as the requisite output of work from the specified intake. We thereupon learn that the 4,000 calorie diet must not only have this energetic value, but that it must also have a specific structure if it is to achieve its function of maintaining output of work. Little by little we build up a frame of reference for this dietetic structure.

There are two quite distinct ways of specifying the pattern of such an optimum diet. It can be specified atomically. Thus the dietician asserts that there are some forty-odd fragments which must be included in it. To provide the diet, we use each fragment as a guide or bearing, and we have to see to it that our food is chosen to provide all the fragments. The other method of specification is illustrated by McCarrison, when he asserts that if we get enough root and leaf vegetables, fruit, whole wheat flour and dairy products, without overloading this diet with sugar or meat, it will have the structure necessary for our health. This statement is not atomic; it is a frame of reference for the *structure* of a diet.

It must be evident by now that in our public thinking there is constantly an interplay between our atomic and our structural frames of reference. This interplay is homologous with the interplay which we examined above, between a visual image and its visual field. This is again an instance of the discontinuous and continuous phases of knowledge.

The critical fact to understand is the mode in which action integrates with such knowledge. If we take a single atomic bearing, the plain fact is that we cannot act on that bearing, and if we try to do so our behaviour is deficient as here shown by our nutrition. Our knowledge is only an adequate guide to our action when the atomic bearings on which we act are integrated with others to convey an idea of an integral structure. It is evident that any complete set of bearings will be used by the continuous phase of knowledge to provide a frame of reference which is structural in type, since being complete it provides all the bearings on this particular structure. This is equivalent to saying that in this field, action can only integrate with knowledge when the frame of reference discloses the pattern of the field as distinct from the validity of isolated bearings.

When we watch how it is customary to talk of causation in the study of this sort of field, we very soon discover that the commonest use of the word relates to the alteration in the recognized field produced by a specific atomic unit. Thus salt in the diet of a patient with kidney disease is said to be the cause of his dropsy; the injection of adrenalin into the body is said to cause the mobilization of sugar from the liver; the bacillus of Klebbs Loeffler causes diphtheria, and so on, and so on, and so on. It is obvious in all this that there is no question of the cause being equal to the effect. Although in an atomized field we follow the causal successions of the units under observation, it cannot be said that in the consideration of structural fields we follow the causal successions of the fields we are observing. We do not say that the pre-dropsical patient is the cause of the dropsical patient, that the pre-adrenalin blood sugar is the cause of the post-adrenalin blood sugar, or that the pre-diphtheritic patient is the cause of the diphtheritic patient. The cause is atomic, the effect is in the field. We have to do with the atomic unit as an agent. We find on post-mortem examination of what has happened that the successions of spontaneous events within our experience may make use of such agents as these. When the pattern changes the stress of change falls at the point which the word agent describes. The example to illustrate this is adrenalin, which is commonly used spontaneously (that is, without the interference of man) by the operations of the autonomic nervous system. On the other hand, man may interfere. He can put adrenalin into the body with a syringe and so slightly alter its characteristic quantitative use, and therefore the pattern of the field. But which is the

most significant—the knowledge of the action of the autonomic nervous system, or knowledge of the slight effects upon its action which the use of adrenalin makes possible to man? It is obvious that the latter is entirely dependent upon the former. In the functioning of a structural pattern, the agents in question may be mechanisms of change. We can then say, when specific changes have occurred, that they must have occurred through the intermediary of such mechanisms. But into the question of why these changes have occurred, our knowledge of mechanism gives us no insight. The account which we give ourselves of this 'why' derives from the continuous phase of knowledge. We say in effect: 'That's the way with these things', and disclose our view of their characteristic performance. In our understanding of these behaviour patterns, cause has no place. We grasp them as the ear picks up a melody; their tunes govern the atomic notes by which we know them. It is true that we have all sorts of tricks of thought and speech which imply a cause. We speak of instincts and habits and emotions as the cause of behaviour, but these are either our means of conveying our understanding of the pattern of behaviour or else the explanation by which we link the frame of reference by which we reach our knowledge with kindred frames. The spontaneity of our universe is not to be comprehended by the notion of cause, nor is its order.

This difficulty in the use of causation—that it traces the succession of recognizable units within the pattern of experience rather than the actual development and elaboration of that pattern—has in the last generation or so called forth new methods of studying the fluctuations of experience. Mass statistics and the laws of probability tell us nothing in detail of the performance of any particular unit or individual, but they tell us a very great deal of the probable response to the field of some individual or other. They tell us in short how the field will behave. They have had their application with dramatic success in such diverse realms as life insurance and electronic and molecular physics. Their effect is to disclose to us a field which behaves in a describable and predictable fashion.

The importance and significance of the notion of the field—with its own inherent order, its fluctuations and transformations, require recognition. There is a sense in which it carries man's thinking beyond its traditional dependence upon the notion of causality and equips him with a frame of reference which is more fully

integrated than any which has previously been available for his use.

It is striking that this method of study is having a curiously disruptive effect upon the standards and units which he has been accustomed to use. This is particularly well seen in modern physics. We find for example that the fixed image of the atom is now subject to criticisms of a new kind. The properties of the varied fields with which atoms are associated require that an atomic unit—whether it be a molecule, an atom or an electron—shall in certain conditions within the field behave in a particular way. In radio-active material certain atoms (nobody can say which) must in a given time break down according to a rule which is expressed in terms of a decay constant. Among reacting chemicals, certain atoms must associate in a manner which is expressible in terms of the valency electrons of atoms. In the incidence of X-Radiation upon matter certain atoms must be affected according to a rule expressed in terms of absorption coefficients. And there are a multiplicity of other fields—crystallization, surface action, colloidal structure, chemical solutions, electrical conductions through gas, through liquid and through solid and so on and so on—in all of which characteristic behaviour within the field has its own implications for the behaviour of the atomized units which comprise it, whatever these units may be. In general of course there are two great groups of units—molecules and atoms—and the correlation between them is by no means clear. For example, in the case of surface tension the field is interpreted in terms of molecules and the relations of these to the atoms which comprise them is at present quite obscure. The atom and the molecule—considered as two frames of reference—have not been brought into equivalence. Or again the atom which is employed by the chemist to explain his chemical reactions, proves under careful examination to be little more than a mechanical model: it is so over-simplified that it may be considered a different unit from that which is used by the physicist. The lack of a principle of equivalence between these two atoms is almost as marked as it is between atoms and molecules. Thus we have gained our knowledge of physical fields at the cost of loss of the standard or publicly agreed quality of the symbols which our atomic units represent.

It is noteworthy that the experimental method proceeds by ascertaining the incidence of events within a field. These events used to be attributed to the units within the field, and images of the behaviour of these units were then formed. Now this method is becoming dis-

credited. The attempt is made instead to correlate the observed incidence of events by complicated mathematical formulae. In so far as this method succeeds in facilitating our comprehension of the fields concerned, it will justify its use. What, as a result, may happen to atomic units, remains, however, a matter for speculation.

There is yet another use of the idea of cause, which for completeness requires to be noticed. In theology it is traditional to speak of God as the first cause. By this it is not meant that atomic successions in which the precedent unit is equal to the subsequent is the very stuff of the totality. Nor does it imply that the particulate and material agents which disclose the focus of a changing pattern, are the arbitrary and disordered expressions of a *deus ex machina.* The true content of the idea is the conviction that the moving pattern itself (which is comprehended so ill) is in its own character unitary, coherent and good. The religious statement is that this pattern makes sense and comforts the hearts of men.

It is evident that when Kant treated knowledge as atomic, and described the function of the mind as the synthesis of an atomized field —in the sense of the adding up of the discontinuous phase of knowledge—he created an artificial situation. Within this he was able to display cause as the corner stone, not because this represents the lineaments of our consciousness, much less the structure of our universe, but because he had inserted into his premise what he thereafter found in his conclusion. Here we discover the crowning error of the Kantian system. In the age of Reason he could still plausibly attempt to treat the mind as the analogue of a causal succession. He was after all only going one better than Descartes who described the body as a machine. Reason, in Kant's system, determined understanding, the understanding determined intuition, and intuition determined the form of sense, and all was atomic. God was the supreme cause, but Kant proved that a regression of causes could not possibly lead to the knowledge of God. This happens to be true. Unhappily for Kant, it proves the case against the Kantian system of reason, and not, as was supposed by some, the case against God.

Succession can only make a reasonable basis for cause in an atomized system wherein all the parts are reduced to a common denominator, whereby a common unit is produced to act as a system of stepping-stones for a cause. Such a system may be useful if by it we can comprehend the structure and function of that which we refer to it.

In the same way a system of dots may be useful to a printer if their arrangement allows him to envisage a structure which our senses can transform into a picture in a daily paper. It is not the succession of dots, but the pattern which we can read into that spatial succession which signifies.

V

THE INANIMATE AND THE LIVING

We have seen how, as men play their part within the universe, they elaborate certain public products of thought which make an indispensable contribution not only to their thinking, but also to their living. It remains to understand, not only how they are produced but also how, when produced, they affect us and how they stand related to the universe to which they refer.

It is useful to divide such public statements into two classes. The first relates to inanimate objects—such as a dynamo. The second to living creatures. These are things that we know and about which we commonly make public statements, and a consideration of them will serve to show how the field of experience which we know, affects the format of the public knowledge which we elaborate.

In the case of the dynamo we draw a diagram of its construction, and on the basis of this are able to show its mode of action. In making our statement we observe that many physical conceptions are integrated into the pattern of our understanding. The principles of electromagnetic induction, the relation between motion, magnetic field and electric current, dielectrics and insulators, the relation of impedance to electrical resistance—these are but samples of the notions which play their part in our understanding of the dynamo. Woven in with these are our standards by which we measure its power, the resistances of its field coils and armature, and so on and so on. Our understanding of one particular dynamo, considered as one facet or corner of our universe results on the one hand from our knowledge of the properties and potential performance which certain arrangements of things give rise to and on the other from what we do to these things and the way in which we arrange them. It is characteristic of these particular objects in this particular arrangement that except when they are energized by electric circuits, they are inert.

This character of inertia is associated with the success of a particular method of thinking—namely, atomic analysis. In the case of the dynamo the essential achievement is the generation and distribution of an electro-motive force. This force is expressed as an aggregate of

units, namely, so many volts. This convention is maintained even when the numerical value of that aggregate fluctuates widely every fiftieth of a second. Such an alternating voltage is treated by the engineer as if it were at the mean pressure which a specific aggregate of volts represents. We may therefore say that although an alternating current acts in a manner which, while fluctuating, is not discontinuously atomic, yet in practice the scientist has found it useful to think of it as if it were atomic. When we pass from this property of voltage or pressure to other associated properties of electrical systems, such as the quantity of electricity which in a particular system moves under the specified pressure, we find the character in question again expressed atomically as so many amperes, although here also there may be gross fluctuation. But when we consider a property with a very characteristic unity of its own such as the inductance of a particular coil within an alternating current system, we still find that the scientist's way is to atomize this unity. He describes the matter as so many linkages per ampere: linkages per ampere, being capable of aggregation and division are suited to atomic treatment. In all this, what we are interested in for the moment is not the result but the method. Such atomic analysis represents one type of observational procedure (and a very useful type) which produces one class of frames of reference. The type of events to which such a procedure and such a frame are suited, is one in which the identity or field under observation is inert in respect of time: that is to say, that the principle of action in the observed identity lies outside itself and does not vary, except as the result of its manipulation or of external influence. Thus, when we observe a dynamo, it appears the same over long periods provided it is in the same phase of its function. Alterations in activity result from operating it. But apart from the mode of action, which its constitution is designed to achieve and which it switches initiate, it is inert. What is more, its decay (its wear and tear) is of characteristic type.

We have here to deal, not only with a method, which may also be described as a point of view; but with a field of experience which appears to be particularly well seen from that point of view. The procedure, the observer and the field have as their product—not simply a dislocated piece of knowledge, a statement in a text-book of pure science: but also practice and application which permit of the transformation of the field by the active participation of the knower.

In all this we are speaking primarily of the realm of the inorganic and man's relation to it. But although the methods of physics and chemistry have their most comprehensive application in the inorganic system, it must be recognized that they can be, and have been, successfully applied to the organic also. It is not my present purpose to discuss how complete the information afforded about organic systems by physics and chemistry is. What at present is at issue is a contrast in the degree of completeness between physico-chemical analysis of the inorganic and physico-chemical analysis of the organic. In the case of the inorganic system, physical (atomic) analysis tells us most of the story. In the case of the organic it does not.

Our philosophical problem is to devise a method by which we may comprehend the phase of our experience which includes the living system. It may seem tedious to approach this by a discussion of the writings of an eighteenth-century logician, but since these are well adapted to show where a particular and still fashionable method falls short, they may also help us to get a grasp of the problem which the method was in fact designed to solve.

Logic is a technique by which the structure of our frames of reference is rendered consistent. One of the greatest exercises in logic which history records for us is provided by Kant's *Critique of Pure Reason*. That exercise started from the assumption that senses are the source of all knowledge and that their operation is atomic. The exposition proceeds to show how the interplay between our faculty of understanding and such atomic sensuous information, gives us an account of our experience. In Kant's examination of the phenomenal, he encounters no major logical difficulty until he comes to explain the initiative of living things. At this point logic falters and fails. This failure is in fact a demonstration of the limitations of the method of atomic analysis. The *Critique* is to be understood not as an exhaustive statement about the nature of experience, but as the logical demonstration of the limits of a method.

Kant's hypothesis, let me repeat, was that the intuitions of sense can be treated as atomic; that knowledge of the external world is fabricated by Reason from these; that knowledge of the internal state is fabricated by Reason from the parallel atomic intuition of the internal sense (this, it is to be noted, was other than the internal senses known to modern physiology, and was obtained by atomizing time); and that all the primary data of knowledge are given by sense, since

thought cannot intuit. Let us take a look at the difficulty which Kant meets with when he comes face to face with the initiative of a living creature such as man. Neither our external nor internal senses can intuit this initiative. The point is that the system which is observed, changes as it is observed, and the pattern of that change is not given by any physical succession. It lies within the system and does not depend in any consistent manner upon external influence. Its comprehension depends upon our grasp, by the continuous phase of our knowledge, of patterns after they have appeared; it cannot be achieved atomically by the discontinuous phase. Kant's way out of this quandary was ingenious. His assertion that all knowledge must pass into the broad chambers of Reason by the pathways of sense and by these only, is deftly laid aside, and he introduces the information, which he requires to know, by a pathway (the 'intelligible') which by his own definition he has excluded.

The detail of the Kantian argument is beyond our present purpose, which is to show that the field of experience, which we may refer to as biological initiative, is not to be comprehended by frames of reference based on atomic analysis. The internal variations of a biological system, which we speak of as its behaviour, only make sense to us when we seek to know that system integrally. The study of atomic fragments within it, although possible, is not the key to comprehension of the variation which experience presents to us.

This is not to deny the existence of recognizable structural and functional units within the make-up of an animal's behaviour. The reflex nervous arc and the conditioned reflexes which Pavlov demonstrated are obviously such units. But these are not atomic units inasmuch as they are built into the behaviour not by aggregation but by integration. They are the elementary patterns which coalesce into larger patterns, and their proper treatment is by the continuous and not by the discontinuous phase of knowledge. What Pavlov has proved is that the building of behaviour patterns is not arbitrary but that it has an order which can be recognized and defined by experiment. He has shown how action is integrated with sense and how it is built upon the recognition and consistency of the events of the external world which affect sense. The position is not dissimilar from that of the insect who sets up a train of action from a specific stimulus of identification. In the insect, however, only one specific act of identification is possible, whereas in the dog the conditioning has not the same

fixity. The identification or sign which leads to action has possible alternatives. The external situation can change without disrupting the behaviour pattern. The importance of Pavlov's demonstration is that it shows the biological organism to be bound up with its environment on the psychological level, just as it is through its food on the level of physiology. The epistemological problem which Pavlov's work presents is, in essence, to grasp how the bell and the plate of food and the digestive function of the dog are inter-related. In short, he presents a pattern to our understanding, and it is the principle of pattern recognition (which Köhler has begun to explore) which alone makes his conclusions comprehensible. In short, Pavlov has devised a public frame of reference which is admirably adapted for the treatment of a certain aspect of the field of biological behaviour.

It is not difficult to demonstrate that this aspect does not include the whole field of biological initiative. Much of the performance of living things does not depend upon repetition, the means by which Pavlov's dogs were conditioned. Much of the behaviour of insects is characterized by a unique performance executed on one critical occasion and never repeated. Many examples are to be found in the writings of Henri Fabre. It is as if the behaviour were carried out upon the assumption that a specific and suitable situation will be reached as a result of it. Usually, this apparent expectation is seen to be fulfilled.

Nor need our illustration be confined to insects. Fishes and birds afford other instances—the migration of salmon up and down streams to the sea; the migration of eels and birds; the first nest-building of the bird, and so on. All these creatures seem to know what to do and in all this, knowledge is unconditioned. That of course is not in any sense an aspersion on Pavlov's work, the interest of which is in its positive and effective statements, not in what it does not attempt to explain. Provided that we understand that Pavlov's contribution is no more than a frame of reference which the flow of knowledge requires us to integrate with other frames, we shall be illuminated and not misled by his statements about behaviour. These are of limited application, but they are about functional patterns, not atomic syntheses.

The diagrams of structure and the atomic analysis by which we comprehend a mechanical object such as a dynamo, are wholly insufficient for the comprehension of the function and behaviour of a

living creature such as the dog. Here we require to comprehend the pattern of function as well as that of structure. Anatomists could describe in detail the structure of such creatures long before the physiologist began to comprehend the character of mammalian physiology or the experimental psychologist to make inquiries about animal behaviour. Nor is this the whole field of our knowledge. Beyond the questions which relate to the individual creature are the less explored fields of the distribution and balance of the many species of animal, insect and plant. In such studies, although units and standards may play their parts, it is evident that the knowledge which we seek is knowledge of a total field, that the pattern of that field is near to the root of our problem, and what is more, we at once discover that what man has done to the field—often in ignorance—is an essential part of what we need to know about it.

If this problem exists in biology, in the allied territory of psychology it is even more acute and dramatic. The psyche or soul does not have dimensions which can be measured in terms of physics. It just is not possible to describe it at all by atomic analysis.

VI

SUM ERGO COGITO

When a man uses his senses to take stock of some entity or object, sensory usage provides that the knowing mind shall not only form to itself an image of it, but also, by the integration of sensory pathways, shall furnish itself with a cross check upon its knowledge.

In the history of philosophy there has been an argument as to whether the images which the senses provide us with, are provoked by real things outside the knower, or are created by the senses themselves. Many of the difficulties which led to the notion that the mind probably created images, arose from the realist's failure to comprehend the continuous phases of thought, which allow of the integration of patterns and symbols. On the other hand, the idealist who attempts to assert that the evidence of his own consciousness is alone valid, has to explain the possibility of his neighbour contributing to the mental processes of which he himself is aware. From the idealist's point of view, the knower is on the one hand aware of how his knowledge develops (that is, his own knowledge), and on the other hand he witnesses the growth of his knowledge (by the contribution of his neighbour) without being aware of the stages which have led up to an integrated and finished process of thinking. The notion of public as distinct from the private thinking requires the assumption, not only that there shall be a public to think, but that that public shall be knowable. Once we establish the evidence of a second knower, that second knower is not only witness to a neighbouring consciousness, he can be known by the senses of the first. But if the system of sensory thinking is valid to tell me about my neighbour, it is equally valid to tell me about the common identities of everyday experience. What is more, my sensory knowledge of identities and patterns can be, and of course is, checked up by the mental machinery of my neighbour.

It is evident that man is aware of his own consciousness, and that this consciousness, and the integration that goes on within it, is far more elaborate and on a far higher level of symbolic reference than is the integration associated with sense. But none the less, if I seek to

make a public statement about consciousness, I establish the same relationship between the knower and the known (although these are here identical), as exists between the knower and the referent in my experience of any other frames of reference, I may attempt to know either the content or structure of consciousness. For example, if my attention is occupied by the interior of a room I can photograph it or, even more impressive, I can record it on a cinematograph film. Thus a cross section of the content of consciousness is arrived at by stopping or fixing the process of thought at some moment of time and holding the product of this interpretation in our attention. The present essay may be used to illustrate an attempt to know the structure of consciousness. It purports to be an integration of many cross-bearings upon consciousness, by which it is hoped something approaching a public frame of reference may be achieved. But these cross sections and frames of reference have to be distinguished from the dynamic continuity of thought (always located in an individual consciousness) which can fuse the pieces of the pattern of knowledge and make the whole available to others for comprehension and action. The act of thought is sudden, integral and certain; it is gone in the thinking and cannot be recaptured. The ideas which it throws out, and which are available to us in our consciousness, are the products of its passing. Their employment depends upon the second coming of the dynamic thought. Thus, beyond the frame of reference, with its convenience for public thinking, we must recognize the phase of experience to which the frame refers. This distinction is of the first consequence and needs to be kept in the forefront of our thinking.

The description of the operations of consciousness in terms of frames of reference has its conveniences, but it also has its dangers. It suggests a fixed and standard arrangement like the scale in the eyepiece of a ballistic galvanometer. Not only would this analogy be misleading, but the use of a symbol of any sort to refer to this intermediate product of our knowing is subject to the limitations which inhere in symbols. Any symbol is in a measure standardized and is therefore in respect of the specific referent, a partial statement. This imperfection of the symbol leads in itself to a sustained endeavour of re-statement which seeks to correct the obvious shortcomings of the original statement; it is evident therefore that in our thinking there is a double dis-equilibrium. The development of experience, including the intervention in experience of consciousness, disturbs our pre-

conceived ideas of experience. And in the attempt to make, as we say, our knowledge fit our experience, we progressively modify public thinking, and indeed public manners, endeavours and objectives.

When sense is atomized into those pre-conscious realms in which it is correct to speak of a unit sensation, neither of the two resulting products, internal and external sensation, can tell us more about the structure of the mind than a collection of bricks can tell us about the structure of a house. How then do we know that the mind has a structure? We can only say that when in the presence of public knowledge we take stock of it, we find that its structure can be displayed. Such knowledge however is the derivative of a procedure or method which knowing uses; it is not the mind in operation. The assumption therefore is that the mind must be there, because we take cross-bearings of it, and we could not do this to something which did not exist. The evidence both of biology, concerning the structure of the central nervous system of animals and their behaviour; and of physiology, concerning the unconscious levels of behaviour co-ordinated in the cerebellum, confirm this. The argument seems to prove that the mind can exist without our knowing it. And if we are to have a science of mind we must achieve it by observational procedure. It is however probably also correct that, apart from and prior to procedures, the mind is self-conscious, and it is this primordial self-knowing (to which we are unable to ascribe a faculty less than the intact mind) which is more precisely explored by procedure. A little thought makes it clear that to know and to-know-the-structure-of-knowing are different. We have to distinguish the knowing of thought from the frame of reference by which we get bearings on that thought-knowing. Knowing patterns and knowing that we know patterns are likewise distinguishable as event and observer. Presumably man's way of recognizing two groups of three lines, /// ///, as a pattern of two, and not of six digits, has always been characteristic of his nature, but it has been brought to our attention anew by the experimental procedure of Köhler and his associates. It has been procedure which has given us knowledge of the structure of our knowing. This knowledge of structure is now available for employment by our knowing.

Observational procedure represents no more than the centre of the interval between the knower and the known. Its product is again taken up by the continuous phase of knowing and is integrated into a pattern of function—a frame of reference which is employed in the

interplay between knower and known. It is the nature of man that he should do just this and the cross-bearings of our frame of reference confirm and demonstrate that this is his nature. This implies that the nature is there first—whether it is known or unknown, that is the 'sum' precedes the 'cogito'. Not 'cogito ergo sum', but 'sum ergo cogito'. The *cogito* is always the procedure of taking bearings on or by the *sum*.

VII

EPISTEMOLOGY OF INSECTS

To envisage the part played by frames of conscious reference within the universe of life, we get help from the consideration of a situation in which such reference, if not absent, is at the most rudimentary. The situation of the insect is of this kind. If we begin by thinking of the details of the performance of one particular insect against the purely material aspects of its world, we find that the qualities of this material world are relatively fixed and constant and that within these material circumstances the character of the creature's environment is largely decided by its actions. For this it needs certain 'knowledge', of which we are able to judge because it is implied by its actions. For example the wasp Bembex includes in its knowledge an ability to identify at least four things, its burrow, the species on which it preys, any material which it uses for 'nest-building', and certain points in the anatomy of its prey. In as much as it has *made* its burrow, the creature is able to depend in its actions upon its world, inasmuch as this is largely represented by its burrow, being as it is. When it begins a sequence of actions at a certain point, the outcome of the interplay of action with situation will be of a certain type, because those actions are suited to its situation as the male is to the female. Here we have causal agency in its simplest form: one event follows from another because the wasp makes it do so. But the cognitive side is very different from what obtains in man. For the insect, the culmination is action: there is no recognition of pattern and no use of frames of reference to discover the pattern. This distinguishes its behaviour from scientific observational procedure in which again identification and action are woven together; but in the latter, it is not the *fixity* of the world which gives results in action: the *variation* in the world gives results in comprehension. Fixity gives place to plasticity.

In order to illustrate the epistemological situation of the insect I propose to quote at very considerable length from the writings of J. Henri Fabre.[1]

[1] *The Hunting Wasps*, p. 310 *et seq.*

'. . . In returning to the dovecote and the burrow, when man has artificially made them lose their bearings and carried them to great distances, in unfamilar directions and into regions which they have not yet visited, are the Pigeon and the Cerceris guided by recollection? Is memory their compass when, on reaching a certain height, whence they can, so to speak, pick up the scent after a fashion, they dart with all their power of wing towards the horizon where their nests are? Is it memory that traces their road through the air, across regions which they are seeing for the first time? Obviously not: there can be no recollection of the unknown. The wasp and the bird are unacquainted with the country around; nothing can have told them the general direction in which they were moved, for the journey was made in the darkness of a closed basket or box. Locality, relative position: everything is unknown to them; and yet they find their way. They therefore have something better than mere memory as a guide: they have a special faculty, a sort of topographical sense of which we cannot possibly form an idea, having nothing similar ourselves.

'I will show by experiment how subtle and precise this faculty is within its narrow province, and also how obtuse and dull it becomes when driven to depart from the usual conditions in which it acts. This is the invariable antithesis of instinct.

'A Bembex actively engaged in feeding her larva, leaves the burrow. She will return presently with the produce of the chase. The entrance is carefully stopped up with sand, which the insect has swept there backwards before going away; there is nothing to distinguish it from other points of the sandy surface; but this does not trouble the wasp, who finds her door with a skill I have already emphasized. Let us devise some insidious plot and change the conditions of the locality in order to perplex the insect. I cover the entrance with a flat stone, the size of my hand. The wasp soon arrives. The great change effected on her threshold during her absence appears to cause her not the slightest hesitation; at least, the Bembex at once alights upon the stone and tries, for an instant, to dig into it, not at random but at a spot corresponding with the opening of the burrow. The hardness of the obstacle soon dissuades her from her enterprise. She then runs about the stone in every direction, goes all round it, slips underneath and begins to dig in the exact direction of her dwelling.

'The flat stone is not enough to mislead our wide-awake friend; we must find something better. To cut things short, I do not allow the

Bembex to continue her excavations, which, I can see, will soon prove successful; I drive her off with my handkerchief. The fairly long absence of the frightened insect will give me time to prepare my snares at leisure. What materials shall I employ now? In these improvised experiments we must know how to turn everything to use. Not far off, on the high road, are the fresh droppings of some beast of burden. The very thing! The droppings are collected, broken up, crumbled and then spread in a layer at least an inch thick on the threshold of the burrow and all around, covering about a quarter of a square yard. This certainly is a house-front the like of which no Bembex ever knew. The colouring, the nature of the materials, the stercoral effluvia all combine to mystify the wasp. Will she take all this—that expanse of manure, that dung—for the front of her door? Why, yes: here she comes! She inspects the unwonted condition of the place from above and settles in the middle of the layer, just opposite the entrance. She digs, makes a hole through the stringy mass and reaches the sand, where she at once finds the orifice of the passage. I stop her and drive her away a second time.

'Is not the precision with which the wasp alights just in front of her door, though this be masked in a way so new to her, a proof that sight and memory are not her only guide? What else can there be? Could it be scent? It is very doubtful, for the emanations from the droppings have not been able to baffle the insect's perspicacity. Still, let us try a different smell. I happen to have on me, as part of my entomological luggage, a small phial of ether. I sweep away the sheet of manure and replace it by a blanket of moss, not very thick, but spreading to a considerable distance; and I pour the contents of my phial on it as soon as I see the Bembex arrive. The ethereal fumes, at first too strong, keep the wasp away, but only for a moment. Then she alights on the moss, which still exhales a very perceptible smell of ether, passes through the obstacles and makes her way indoors. The ethereal effluvia put her out no more than did the stercoral effluvia. Something surer than scent tells her where her nest lies.

'The antennae have often been suggested as the seat of a special sense able to guide insects. I have already shown how the amputation of these organs seems in no way to impede the wasp's investigations. Let us try once more, under more complicated conditions. I seize the Bembex, cut off her antennae at the roots, and at once release her. Goaded by pain, maddened at having been imprisoned in my fingers,

the insect darts off faster than an arrow. I have to wait a good hour, very uncertain as to whether it will come back. The wasp arrives however and, with her unvarying precision, alights close to her door, whose appearance I have quite changed for the fourth time. The site of the nest is now covered with a spreading mosaic of pebbles the size of a walnut. My work, which as regards the Bembex, surpasses what the megalithic monuments of Brittany or the rows of menhirs at Carnac are to us, is powerless to deceive the mutilated insect. Though deprived of her antennae, the wasp finds her entrance in the middle of my mosaic as easily as the same insect, supplied with those organs, would have done under other conditions. This time I let the faithful mother go indoors in peace.

'Four successive alterations in the site; changes in the colour, the smell, the materials of the outside of the home; lastly, the pain of a double wound: all had failed to baffle the wasp or even to make her waver as to the precise locality of her door. I had come to the end of my stratagems and understood less than ever how the insect, if it possess no special guide in some faculty unknown to us, can find its way when sight and scent are baffled by the artifices which I have mentioned.

'A few days later, a lucky experiment reopened the question and allowed me to study it under another aspect. In this case we uncover the Bembex' burrow all the way along, without changing its appearance too much, an operation made easier by the shallowness of the burrow, its almost horizontal direction, and the lack of consistency of the soil in which it is dug. With this object we scrape away the sand gradually with a knife. Thus deprived of its roof from end to end, the underground dwelling becomes an open trench, a conduit, straight or curved, some eight inches long, open at the spot where the entrance-door used to be and finishing in a blind alley at the other end, where the larva lies amid its victuals.

'Here is the home uncovered, in the bright light, under the sun's rays. How will the mother behave on her return? Let us consider the question in detail, according to scientific precepts: it is a perplexing position for the observer, as my recent experiences make me suspect. Here is the problem: the mother on arriving has the feeding of her larva as her object in view; but to reach this larva she must first find the door. The grub and the entrance-door: those are the two aspects of the question that appear to me to merit separate consideration. I

therefore take away the grub, together with the provisions, and the end of the passage becomes a clear space. After making these preparations there is nothing to do but exercise patience.

'The wasp arrives at last and goes straight to where its door ought to be, that door of which nought but the threshold remains. Here, for more than an hour, I see her digging on the surface, sweeping, making the sand fly, and persisting, not in scooping out a new gallery, but in looking for that loose door which ought easily to give way before a mere push of the head and let the insect through. Instead of yielding materials, she finds firm soil, not yet disturbed. Warned by this resistance, she confines herself to exploring the surface, always in close proximity to the spot where the entrance should be. A few inches on either side is all that she allows herself. The places which she has already tested and swept twenty times over she returns to test and sweep again, unable to bring herself to leave her narrow radius, so obstinate is her conviction that her door must be here and not elsewhere. Several times in succession I push her gently with a straw to some other point. She will not be put off: she returns straightway to the place where the door once stood. At rare intervals the gallery, now an open trench, seems to attract her attention, though very faintly. The Bembex takes a few steps towards it, still raking, and then goes back to the entrance. Twice or thrice I see her run the whole length of the conduit and reach the blind alley, the abode of her grub; here she gives a few careless strokes of the rake and hurries back to the spot where the entrance used to be, continuing her quest there with a persistency that ends by wearying mine. More than an hour has passed and the stubborn wasp is still pursuing her search on the site of the vanished doorway.

'What will happen when the larva is present? This is the next aspect of the question. To continue the experiment with the same Bembex would not have given me the positive evidence which I wanted, for the insect, rendered more obstinate by its vain quest, seemed to me now obsessed by a fixed idea, which would certainly have obscured the facts which I wished to ascertain. I needed a fresh subject, one not over-excited and solely concerned with the impulses of the first moment. An opportunity soon presented itself.

'I uncover the burrow from end to end as I have just explained, but without touching the contents: I leave the larva in its place, I respect the provisions; everything in the house is in order; there is nothing

lacking but the roof. The eye freely takes in every detail of this open dwelling: entrance-hall, gallery, cell at the back with the grub and its heap of flies; this dwelling has now become a trench, and in front of this and the larva, wriggling under the blistering rays of the sun, the mother behaves exactly as her predecessor did. She alights at the point where the entrance used to be. It is here that she does her digging and sweeping; and it is here that she always returns after a few hurried visits elsewhere, within a radius of a few inches. There is no exploration of the tunnel, no anxiety about the tortured larva. The grub, whose delicate epidermis has just passed from the cool moisture of an underground cave to the fierce blaze of an untempered sun, is writhing on its heap of chewed flies; the mother does not give it a thought. To her it is no more than any other object lying on the sand: a little pebble, a pellet of earth, a scrap of dry mud, nothing more. It is unworthy of attention. This tender and faithful mother, who wears herself out in trying to reach her nursling's cradle, is wanting at the moment her entrance-door, the usual door and nothing but that door. What stirs her maternal heart is her yearning for the well-known passage. And yet the way is open: there is nothing to stop the mother; and the grub, the ultimate object of her anxiety, is tossing restlessly before her eyes. One bound would bring her to the side of the poor thing clamouring for assistance. Why does she not rush to her beloved nursling? She could dig it a new dwelling and swiftly place it in safety underground. But no; the mother persists in seeking a passage that no longer exists, while her child is grilling in the sun before her eyes. My surprise is intense in the presence of this short-sighted mother, though the sense of motherhood is the most powerful and resourceful of all the feelings that stir the animal creation. I should hardly believe the evidence of my eyes but for experiments endlessly repeated with Cerceres and Philanthi as well as with Bembex of different species.

'Here is something more remarkable still: the mother, after prolonged hesitation, at last enters the roofless trench, all that remains of the original corridor. She goes forward, draws back, goes forward again, giving a few careless sweeps, here and there, without stopping. Guided by vague recollections and perhaps also by the smell of game emitted by the heap of flies, she occasionally reaches the end of the gallery, the very spot at which the larva lies. Mother and son are now together. At this moment of meeting, after long suffering, have we a display of eager solicitude, exuberant affection, any signs whatever of

maternal joy? If you think so, you need only repeat my experiments to persuade yourself to the contrary. The Bembex does not recognize her larva at all; it is to her a worthless thing, something in her way, a nuisance. She walks over the grub, treads on it ruthlessly, as she hurries to and fro. When she wants to try and dig at the bottom of the cell, she thrusts it back with a brutal kick; she shoves it on one side, topples it over, flings it out as unceremoniously as if it were a big bit of gravel that hindered her in her work. Thus knocked about, the grub thinks of defending itself. I have seen it seize its mother by the tarsus with no more ceremony than it shows when it bites off the leg of its prey, the fly. The struggle was hotly contested; but at last the fierce mandibles let go and the mother vanished in terror, making a shrill whimpering noise with her wings. This unnatural sight of the son biting his mother and perhaps even trying to eat her is uncommon and is brought about by circumstances which the observer has not at his command; but what can always be witnessed is the wasp's profound indifference towards her offspring and the brutal contempt with which she treats that irksome lump of rubbish, the grub. Once she has raked out the end of the passage, which is the work of a moment, the Bembex returns to her favourite spot, the threshold where she resumes her useless search. As for the grub, it continues to writhe and wriggle wherever its mother has kicked it. It will die without the mother's coming to its assistance, for she fails to recognize it because she was unable to find the customary passage. Go back to-morrow and you shall see it lying in its trench, half baked by the sun and already a prey to the very flies that were once its prey.

'Such is the concatenation of instinctive actions, linked one to the other in an order which the gravest circumstances are powerless to disturb. What, after all, is the Bembex looking for? Her larva obviously. But, to get at that larva, she must enter the burrow; and, to enter that burrow, she must first of all find the door. And it is in the search for this door that the mother persists, despite the wide-open gallery, despite the provisions, despite the grub, all exposed to view. At the moment she cares not that her house is in ruins and her family in danger; what she wants above all things is the familiar passage, the passage through the loose sand. Perish everything, dwelling and inmate, if this passage be not found! Her actions are like a series of echoes each awakening the next in a settled order, which allows none to sound until the previous one has been sounded. The first action

could not be performed, not because of an obstacle, for the house is wide open, but for the want of the usual entrance. That is enough: the subsequent actions shall not be performed; the first echo is dumb and all the rest are silent. . . .'

This experiment of Fabre, like many others instanced in his writings, shows that the insect's instinctive actions are linked with its situation by certain acts of identification. It depends upon its world being of a certain pattern: it is able so to depend because its own actions themselves are adjusted to the physical and biological conditions of that world and, as in the making of a burrow, contribute largely to the character of its environment. These acts of identification often have an extreme, indeed an astonishing facility, but they are primitive in character. In spite of this they are adequate provided the accidental does not occur. In the face of the accidental the hazards become enormous: commonly the outcome of the accidental is death. Although we have no evidence that the insect consciously knows its situation, none the less it is clear that it experiences an imperious inner compulsion of which the evidence is its behaviour. In some instances this compulsion to action adjusts the creature to the hazards of its world. Instinct lays upon the insect certain inflexible obligations. Usually the world in which those obligations are fulfilled is such that the resulting attempt to live meets with success. The instinct of the insect is suited to its world and conversely the world of the insect is suited to the pattern of instinct which it displays.

When, however, some event occurs which disturbs the normal pattern of events on which the insect relies, it cannot comprehend the changed situation. In these circumstances what it does is to repeat its standard responses blindly, until either it manages to become again adjusted to its world, or if its persistence has no such happy outcome the creature will continue in its compulsive behaviour even though its blind following of instinct brings it to its death. The insect never retraces its actions. What is done, is done and cannot be recommenced.

In the life of the insect, the situation in which it lives and the actions of the creature within that situation are interwoven without the creature being conscious either of its gestalt or of its own performance.

In man also there is again the wide underlying *unconscious* attitude of the creature within the realms of Life. There are again impulses

and attitudes which exert considerable constraint upon our behaviour. But because these impulses are less fixed, they allow a much greater adaptability in their integration with the situation of the external world, into contact with which man's experience brings him. The organ of this adaptation is consciousness. It is by consciousness that we both recognize the event which throws out the pattern, and alter our response to suit the altered pattern. The certainty of a fixed response in an unconscious world gives place to the hesitation, choice and error of a plastic response, in a world partly illuminated by consciousness and its frames of reference. But the certainty of instinctive response fails before the accidental and such failure is usually the pathway to death. Consciousness moves with no such certainty, but because it can deal with the fluctuating and the accidental it can operate in a universe of far greater scope, whereas the fixity of the insect's world is secured by the limitation both of its habitat and of its performance within that habitat. Man is able to occupy all habitats and to open up a constantly extending performance because by consciousness he can wed his impulses and attitudes to wellnigh all habitats, dealing with the accidental and the fluctuating over vast realms of experience.

Man's naïve wonder at finding something another creature can do which he, the Lord of Creation, cannot, has led to a gross overvaluation of instinct. This is a pity since it tends to obscure those contrasts which are capable of making clear to man the true nature of his own behaviour. The pre-eminent feature of man is his consciousness. And all the evidence which we have, suggests that the insect lacks this completely. But if it is true that for the insect there exists around and beyond it a universe of which it knows nothing, it is equally true that around and beyond man there is likewise a universe of which he does not know very much. If we find in the instinctive behaviour of the insect an impulse to action which we see to be fitting, and yet of which we comprehend little beyond the fact of its existence; in man it is our experience that of the personal and the social impulses, including all our so-called creative urges, the chief thing which we can say is 'I am that I am'. But the impulses which rise up from the unconscious depths of the psyche encounter an outward universe. Our being and our life is set in the midst of, and woven warp and woof with the whole cosmos of other beings and other lives. Between us and these operates the spotlight of consciousness.

We have seen that this functions by means of an imperfect and a laboriously employed faculty of knowledge. By this man is distinguished from the insect.

By consciousness the fixed world of the insect is made to give place to the plasticity and the fluctuations of the world of men. But let this endowment be mentioned with humility. The world in which man acts out his part is still unknown, and the impulse still springs unpredictably and spontaneously out of his inner unconscious being. In this, man's biological situation is essentially comparable with that of those other living creatures—the insects. Nor should man in his arrogance here point to the marvels of his material achievement. The insect is no mean artificer. In the domain of plastics it has to its credit many achievements which as yet entirely outstrip the wit and the skill of men. Instead of boasting of our manipulation of materials to ends which we cannot formulate, by methods which by no means give us satisfaction, we should do well to pause and witness how, out of the depths of personality, the spontaneous urge can and does impel us to a range of performance and to a scope of living to which no other species has been ordained to aspire. If the bee, like the pigeon, finds one point in space with an accuracy which man cannot rival, none the less man has taken the whole of space for his province. His impulse to action is of greater scope. That great scope is matched by the complexity of the organ which serves it—namely, the brain which is the seat of human consciousness. But space and the material which it contains do not define the limit of human impulse. Space is but a frame of reference by which one phase of experience is known. Life—not only in its material organization, but also as the agent of order, and as the mystery, the still unknown, which is beyond material and order—is both the source of each particular consciousness and the Universal which, being beyond all men, challenges their collective comprehension.

VIII

THE INDWELLING PATTERN OF LIFE

The impulse to action, which moves through instinctive and preconscious response and primitive symbol, is very evidently essential to the total pattern of living function. It is in virtue of its impulsions that life is able to move in its own regularity. If we conceive the universe as that which is beyond man and outside the limits of his individuality, it is clear that the total pattern of instinctive behaviour passes far beyond man and that, in his preconscious and unconscious, it fades off into continuity with life and the universe of life.

When therefore the scientist takes up the conscious study of the modes of life, the field of his studies is not simply something which he sees as a spectator: it is also something which he experiences as a creature through this non-conceptual make-up. What is true of the individual scientist is still more true of society and its culture. In addition to undergoing the influence of frames of public reference which we considered in detail in the first part of this book, the public is affected from underneath by its preconceptual insight and its collective unconscious. But what is reached back to through the unconscious is the same as that which is reached out to through the conscious. It is in each case the same universe.

A public system of conscious reference is accompanied in society by a system of manners, integrated in part from this conscious view and in part from the attitudes and impulses of the preconscious and the collective unconscious. When the integration of the unconscious and the conscious into one whole is hesitant and incomplete, not only does Nature cease to keep its influence on manners, but society as a whole becomes less aware of the Natural Universe. Since man is a creature before he is a mind, this loss of awareness brings ignorance not only of the universe but also of man himself. Since the 'age of reason' culture instead of depending upon its intuitive knowledge of man, has tended increasingly to interpret the human situation in terms of its intellectually constructed frames of reference. These frames being what they are, the shift has been toward knowing man as a thing and

away from knowing man as a subject, an agent in his own right under the endowment of life.

When man stands in no pre-eminence over things he is seen as undergoing the same sort of influence as things. He is conceived then as the object of material causation and the dialectics of materialism govern the great drama of history. The structure of his society takes shape under the pre-conceptions of this conscious view. It takes on mechanical form, and the whole of man's creative urge is driven into the mould of his conscious conceptions. The aim of society is then to make itself an efficient mechanism, like a building or machine. It is out of this situation that the need for THE PLAN arises at every vista. But while all this is happening, what of man himself?

The psyche in its experience of the universe is now like a tree before a prevailing wind. Its growth is constrained and twisted. Adjustment to society and the service of the needs of society are given over-riding priority. Either the psyche is unbridled and disposes of arbitrary power as in the Fascist leader, or the phase of the psyche which has pre-eminence is the *persona*—the point at which a compromise is reached between the individual and society. He who can best and most ably adjust himself to the planned requirements of society, whilst suppressing to the limit the inward necessities of the soul or psyche and the urge and movement of the individual and collective unconscious—that man best meets the need of the contemporary situation; and him the contemporary situation, for better or worse, endows with success.

It is obvious that in these circumstances intuitive sensibility and the creativeness of the unconscious receive minimal encouragement from society. Indeed society does not even inquire how such encouragement could be given. It is hardly aware that life moves by its own motion which uses, but is not governed by, thought. The reference of the public knowledge on which society now depends is exclusive. Its constructed frameworks of thought suffer from the predominance of physical notions. The specifically living qualities of life on the other hand, are concealed or overlooked as a result of the bias which public consciousness has for the atomic and physical.

There is something which comes to a man, a family, and a culture from its living as well as from its thinking. The potential integrity of living springs out of the very essence of what the living thing is. The song of the lark, the nuptial flight of the bee, the ability of the seed to

turn itself into the grown plant, to fruit and seed again—each of these performances is so characteristic of a particular unit of life, that it could be said that we derive our idea of what life is from such instances. There is something in life which takes up and plays its part with complete spontaneity. The intellect is no more than the agent and the witness of such spontaneous living. What is more, since, when we get to that level of living at which conscious knowledge enters in, action enters into knowledge; this quality of spontaneous living makes, through action, its own essential contribution to our knowledge and our culture. This is true not only within the narrow precincts of scientific thinking, but also in the most inward recesses of our culture.

The spontaneity of living things is little understood, and we have as yet few and inadequate public frames of reference in this territory. As we contemplate the situation of the living thing we establish that its fulfilment demands certain conditions. The living thing is part of its background and its background is in the main such as to make its performance possible. But none the less there is room within its order for disorder. It is not ordained to come of necessity to the perfection of its development. Even on the physiological level, malnutrition, dysfunction, infection, infestation and inco-ordination commonly interfere in the function of the living organism. And, indeed, perfection of development is not something static. Man moves through his seven ages: the infant, the schoolboy, the lover, the soldier, the justice, the slippered pantaloon and the old man. Each age has its character, and that character can at each age be brought to its perfection. As with man so with woman: from maid to wife and motherhood is the common path of womanly achievement. But in each and any of these stages of living, fulfilment may be withheld. Consequently the sense in which it is true to say that the character of any age can be brought to perfection requires careful examination. We meet with rare examples of fulfilment when the pattern of adolescence or of young manhood seems to be perfected. And so with each and every stage of human development. But concerning the pattern of development as a whole and each stage into which it naturally divides, these are matters to which our public frames of reference pay little attention. Consequently the contrast between the lean and slippered pantaloon and man as he may be in his sixties, is a matter which, in our public knowledge, remains unexplored. With the other stages the position is

parallel. The vitality and the zest which is realized in rare instances should raise the sights of our public knowledge and indicate to us what the human being, when properly nurtured and cultivated, is capable of. But here, as yet, our public frames of reference fail us.

It is difficult to grasp that although the movement in its own self which distinguishes life is something of which we become aware, it is not our consciousness which bestows its initiative upon it. There is an underlying order and pattern in life which is manifest in its integration; and the initiative of men and societies is limited to the combinations and the development which are possible within that integration. The spontaneity, the order and the potentials of development which life displays, move in their own right. They are not born of consciousness. Indeed consciousness can only become creative when it has an adequate frame of reference for that creative spontaneity which life itself displays.

Now at the fag end of an 'Age of Reason', we are able to look back and see what eventuates when man sets up his all-conquering will against this underlying order of life. Such men of 'reason' believe that there is little which cannot be altered by the determined will of individuals. Their approach to Reality is God-like. First they consider how they wish the world to be. Then by the power of the human will and the great voice of the democracy they set out to make it so. But creation is not of the mind, nor in this instance, of the word or verbal symbol. Here creation is of the flesh. The preconscious drive and the being, which, alive, moves in its own right are the immediate artificers of all new worlds. To help the future we should do well to turn away from men of determination with their plans and their blue-prints and their visions of a new heaven and a new earth. For the old earth is still here. It has within itself an order, a potential and a spontaneity which possess more than the cold illumination of the mind. They possess within themselves the fertility which is life. This fertility, man, by his will and his determination, can drive into all sorts of hideous shapes and contortions. Or if he will, he can nurture and promote it. When he makes an end of all his willing and driving and allows himself leisure to look at his handiwork he will if he is honest discover, that except he sought to nurture the thrust of the indwelling pattern of life, all his labour is to thwart and deface that same urge.

Not that the urge of life is to be understood as some separable

quality, some Elan Vital or Life Force—something ordained to progress and thereby to a millennium. The urge of life is no more than its autonomy, something little understood—a disposition towards its own fulfilment, manifest in the particularities of life. It appears to be associated with a greater architecture of order, but this has no sanctions to enforce its power. Obviously man can and does damage that architecture. When damaged it has the capacity of life to heal itself. But again there is no necessity in healing.

At the moment the indwelling pattern of life demands our attention, not because it is rushing ever onwards to some strange and slightly inhuman consummation wherein a changed and improved man will find a transmogrified glory in a world of strange futurity: on the contrary, the architecture of biological order is to-day significant to us precisely because it is a truth which twentieth-century man denies, suppresses or ignores.

IX

ITS SOCIAL IMPLICATIONS

Biological order is the nursery of that potency and fertility of life which, moving through its proper order, is alone capable of giving quality and richness to the associations of men. But the human soul is a delicate and sensitive growth and the order after which its potential strives is indwelling. According to the theologian it is the gift of Grace which cannot be commanded. The scientist would do well not to scoff at this age-long understanding of man's spiritual make-up. It is true that the terms of its reference are not such as the scientist can handle. But the situation to which the theologian here refers thrusts itself increasingly upon the scientist's attention. We thus find Jung affirming that psychic energy will only flow along certain channels within the psyche; and, although this statement is not only a scientific analogy (being an application of the law of the conservation of energy—a purely physical law—to the affairs of the spirit), but also an extremely clumsy one; yet this psychologist is undoubtedly groping after the same truth which the theologian has long known and expressed in terms of Grace.

The autonomy of life, whether it is manifest in individual conscience, or socially through the family, is a quality which experience shows to be commonly, even consistently, thwarted and diminished. Its fulfilment is sporadic. Frustration of spiritual development is peculiarly predominant in our time by reason of the overwhelming bias of materialism, a view-point which implies not only preoccupation with material ends, but also the use of the frames of reference proper to the physicist in realms of experience which lie far beyond the reach of physics, in the psyche and the bios. How such a state of public knowledge bears back and weighs upon and devitalizes the human soul must be understood before we are able to envisage how the inward quality of human families can be released to make its full contribution to the society of men.

At this point such public knowledge as we have is at fault. Society, which has been built up by the actions of men, is disclosed to us by the operation of our public frames of reference. The layout and disposi-

tion of society, in the sense of its material existence, is known to us from the observations of our senses, built into knowledge in a manner studied in Part I. The product of this knowledge is a fixed cross-section of society as it is now; it is no more than a frame of reference. The impulses of men which tend to modify society are, however, for reasons which we have discussed, ill-comprehended by current systems of thought. Yet society is continuously being modified by these same impulses. We thus recognize that the 'cross section' of society changes without at the same time recognizing the quality of human achievement, that indwelling potential of human living, which is the artificer of change. This urge or performance is, in respect of knowledge, like the social outcast, the cad whom his neighbours won't recognize. Just as the cad is a thwarted personality, so the inner impulses of which we here speak represent a potential zest which, under the snobbishness of materialism, of a system of public knowledge, that is, which denies them recognition—has been damped and distorted. The power of the personality has been focused upon material needs and material manipulations.

The autonomy and initiative of the person is not only the birthright of the individual, but, at that point where the individual is built into social relationship through the family, is also the very fountain out of which the life of society must spring. The public, however, has lost sight of the source of its initiative and those inner impulses of culture by which social change is brought about. Yet the fact of social change remains known. And to explain it men have turned their eyes outwards towards the world which sense makes manifest. They, the conscious representatives of the Wheel of Life, have under the endowment of Life *made* the society of which their senses now give them knowledge. In the confusion to which their ignorance of their own potential gives rise, however, they have turned to their conscious knowledge of the external world and there seek those principles of social change which are to be found only in the sources of their own spiritual power. They project upon the material world the dignity of their own birthright as the responsible agents of Life.

From their public knowledge of the material aspects of social life, the present generation formulates its dream of change which it calls Progress. It matters little what that dream is. The mere existence of such a formulated plan places the initiative of society at the centre. But to make it effective compulsion is required. And although we pay

less attention to this point, compulsion carries with it the corollary of being compelled. If men have to adjust themselves to an ideologically planned society their own spontaneity and autonomy is cabined and constrained. It is true that by compulsion the State can theoretically provide opportunity. But it cannot command the utilization of opportunity. Such utilization is locked up within the appetite and the autonomy of the individual and the family. Liberty can only flourish by promoting autonomy and the appetite for experience among the persons and families who are the units of society. Corporations and institutions only serve society well when they satisfy and promote the inner needs of the people whose association that society is. What then of a society which knows nothing at all of those inner needs?

If we ask what proper place Authority can fill in a society of free men, the answer must be that its spiritual mandate must be drawn from its capacity to further the native organization and the spontaneity of the life within its scope. This, in the nature of things, compulsion cannot do.

It is part of the task of knowledge to take cognizance of the order and integration of Life. The liberty with which such knowledge endows men is a liberty of responsibility. Such responsible liberty is indivisible. To attempt to weigh, measure and divide liberty—whether the outcome is four or forty freedoms—is to turn away from order and integration. Only by cultivating the sources of that self-regulation which tends towards integration can Authority distinguish its performance from that of tyranny.

The problems which life presents to conscious knowledge are problems of experience. In this they mainly defy interpretation in terms of causation, which is a principle of the internal economy of our frames of reference. Life is the field to be known, not the method of knowledge; and the relation between man and life is not only that of knower and known, it is also the interplay between man and his universe; and of this conscious conceptual knowledge comprises only a part.

In so far, however, as this interplay and relationship is a public phase of our experience, we can, by the methods of conceptual knowledge, build up a frame of public reference by which to know it. No complete or adequate framework at present exists. But to say that the more essential elements within this area of our experience have not

been fully explored does not mean that we cannot recognize what these elements are.

To enter into a detailed inquiry into the nature of life is obviously no part of a discussion of the principles of public knowledge. But just as the twin questions of how the physicist is able to know about energy, and what sort of knowledge he gets within this field by his methods, proved to be both relevant and instructive to our inquiry; so also in the territory of life similar questions arise. Here however we are dealing, not with a fully elaborated and developed method, but rather with a problem for the solution of which the method is still to seek. In consequence we can at present do little more than indicate the nature of the problem and of the experience which we have already gained from a provisional approach to it. Although our insight is hazy and our experience limited, nevertheless even these beginnings of knowledge have implications for our guidance which are of a radical and disturbing character.

In the consideration of life there are at least three great characteristics which command our attention. These are the characteristic performance of the living thing, its spontaneity and the fact of propagation.

In the development of a life history, in the precision of their interplay with their environment, and in instinctive behaviour, the lower forms of life display a pattern of living which is readily recognizable and which in most instances runs true to type. But when plant and animal are left behind and we enter upon the study of man, the problem of the recognition of the characteristic performance is no longer straightforward. The simple observation of what contemporary man is up to, does not disclose to us the pattern of his characteristic performance. Our inquiry reveals a conflict between the Nature of man and his will. And to this is added the evidence of psychology that compulsive behaviour patterns and other forms of 'complex' break into and disrupt the autonomy of the person, so that very often even the plain observation of what the individual does, discloses not a characteristic performance in the sense of an integrated and completed pattern, but a confusion which results because the potentials of performance have never been realized.

The fact of spontaneity in a living system is a reminder that the development of characteristic performance is not a standard effect. The potentials of development are specific to the individual. Talent,

wit and intelligence vary with the native endowment of the person and what is more, the incidence of creative insight and creative achievement is sporadic and unpredictable. No doubt such qualities can be, and often are, held back and frustrated by the poor soil in which they grow, but even when the soil is carefully tended and prepared, none can predict the degree of perfection which each individual seed will achieve. We must never lose sight of the fact that man is like the insect in his orientation towards his situation in that he remains unaware of much of the territory of his spiritual performance. Consciousness does not disclose his total situation: it merely allows elasticity of response to the immense variety of detail, much of it unpredictable, within the intruding universe which he experiences.

When we turn our attention to propagation we are confronted by different considerations. For the birth of a child the individual is not sufficient. Procreation, because it implies a grouping of two specific individuals is already a social act. About this grouping is built the fundamental unit of society—the family. The fact that man is a social animal has to be constantly borne in mind in all discussions of public knowledge. Language and communication are transmitted through the family. What is more, the fundamental bedrock of education is of necessity the family. It is from these beginnings that the later flowering of culture, whatever its scope, and whatever it feeds upon, ultimately develops. When we turn from education to religion we discover that it is 'when two or three are gathered together' that the conditions in which religious practice is facilitated are established. Thus religion also is a social aspect of man's living. The development of the person who is capable of using knowledge is dependent upon the conditions which make that development possible and among these the integrity and quality of the family group is pre-eminent.

Our knowledge of these characteristics of life is of course arrived at by the methods of conceptual knowledge which have been discussed in part one of this book. It is as much the outcome of scientific thinking in the field of biology, as gravitation is in the field of physics. There is however this complication. The object which is known is here also the subject. Life in man and in the society of men is not only the thing known, it is also the experience in which man participates. The experimental demonstration of the potentials of human life is not the moving force within life. That moving force operates in its own right and is motivated in large measure from the preconscious realm of the

psyche. Conscious knowledge may provide us with a running commentary upon the function of the indwelling pattern of life. That pattern may use knowledge. But knowledge cannot create the pattern. The characteristic performance, the spontaneity and the propagation of life are far deeper and much more extensive than consciousness.

Although there is a principle of action inherent within every living system including that of man, yet at the same time this capacity to move outwards from itself encounters an external and, in man, a political world, into which it interweaves and by which it is conditioned. This conditioning takes place either by what may be described as the *supply* of opportunity, or by the *utilization* of opportunity. The case of the supply of opportunity is easily comprehended. The obvious illustration is afforded by nutrition. In cases where there is gross and persistent deficiency in certain elements in a diet, the body becomes diseased and the person suffers from anaemia, rickets, scurvy or some other deficiency. In these cases it is clear that the body is unable to arrive at its characteristic healthy performance by reason of its conditioning—its world has too little to offer it by way of food. But this is not the whole story. The world may not fail. Supplies may be plentiful. And still the body may display physical deficiency. This depends not on supply but on utilization. Although the world offers the requisites of body building, the body may fail to make use of them. This conception of the utilization of supplies and of opportunity is of the very first consequence in the study of life. It cannot be too sharply emphasized or too fully explored.

This is to say that man, like other creatures, may be deficient in the purely vegetative level and that the vegetative deficiency may diminish the scope of his biological and cultural performance at every higher level.

That which is made possible by man's vegetative performance is mediated by the plasticity of his organs of comprehension. By this plasticity—which instinctive behaviour entirely lacks—he can respond to an altered and a fluctuating situation. The characteristic organization of his vegetative make-up permits of characteristic performance within this field and thereby makes possible the integration of the principle of life within him with the manifest order of life beyond him. His powers of integration are facilitated by use, so that we are able to speak of experience feeding his potential performance. But in this wider field of the interplay of conscious man with the world about

him, the twin issues of the supply or availability of experience on the one hand and the utilization of experience on the other, constantly occur. It may be added that at present the issue of utilization is closer to the heart of our problem and yet it is constantly minimized or overlooked in our thinking.

X

LIFE AND SOCIETY

Although the character of life arises intrinsically out of its own performance we find, as a matter of experience, that the performance which typifies a species is consonant with the parallel performance of other species. At times the detail of this, when one or two species only are considered, may be difficult to follow. But taken by and large it is very evident that the whole Kingdom of Life—vegetation, beasts and soil, that is to say the whole Wheel of Life—agrees well together and forms a coherent and impressive whole.

In contrast to Life, the performance or function of consciousness is not inherent or self-regarding. Consciousness itself signifies less to us than does that to which consciousness witnesses—that which we are conscious of. In the lower animals, supply and opportunity are seen to be provided by the layout of their world. This, together with the instinctive responses which distinguish life at these levels, make possible their characteristic performance as living beings. The environment is sufficiently propitious and, at the same time, the living performance is such as is suited to use that environment. But with conscious man, the supply and the availability of opportunity is witnessed to by consciousness, since it is by this faculty that we know our world. Yet when it comes to utilization, consciousness is no longer the root of the matter. Here man of necessity falls back from consciousness to the living principle within him. All that consciousness can properly do is to serve that principle.

Although this is the proper function of consciousness, yet the will of man is free. There are other ways in which man can and does use his consciousness. The chief of these is to present the external world as the cause and sanction for human action. Modern times have seen the prevalence of such usages of consciousness in an extreme degree. In the doctrines of dialectical materialism and the material interpretation of history, man is treated as if the principle of life was extrinsic to him; as if the principles of order and motivation were in the world of consciousness which is external to man; and as if there was to be encountered in man nothing more than the passive capacity for re-

action to these external determinants. Such a doctrine is of course a frame of public reference to which public and private action can be adjusted. Not only is this a characteristically modern frame of reference: it also displays the characteristic modern distortion. It is an attempt to know life as if neither characteristic performance, spontaneity, nor propagation with its social implications were distinctive of it.

What is here described on the general cultural level has its application also in the development and behaviour of the individual psyche. We see this in the conviction of the West that it is the work man does and not what the man is which matters. The implication is that for man to realize his personality he must 'get on' in the world, and he must do this by getting mixed up in economic and social causation. He must contribute as a control to the running of the machine. Success is the common objective. When this situation is carefully watched, it is seen to result in exacting and constant demands upon the personality by the format of the external world. The predominance of this understanding of man's situation offers great obstruction to the indwelling potentials of human performance on every level except the material.

This situation necessarily leads to the discouragement and inhibition of these potentials. The soil is no longer favourable to their growth. Motive no longer springs spontaneously from the inner urge of men. In order to make the external world work and to keep the great social machine in operation, compulsion becomes everywhere more and more necessary. Such compulsion, since it frustrates and contradicts the indwelling potency of human spontaneity, leads to apathy on the one hand and to the release of forces of destruction on the other. These show themselves both within the psyche—leading to the increasing incidence of neurosis; and within society—with its uneasy class conflicts and its devastating wars.

The attempt of consciousness to understand Life by using the assumptions of materialism for its frame of reference, is at the root of the modern distortion both of thinking and of living. It follows from the nature of knowledge, and the necessary association of action and performance with knowledge, that where man's understanding of his situation is partial and incomplete, he must by his actions build up a similar lopsidedness, not only in his actions, but also in his society which is, of course, his handiwork. Man, however, is not aware of this

lopsidedness. His consciousness does not disclose out of its own nature the bias which it has itself created. Indeed if he uses consciousness to give himself a plain factual description of his distorted society, the imperfect view which results appears to him as the norm, the reality to which it should be the high objective of civic man to adjust himself.

The effect of gross imperfection in public knowledge—such as exists at present through the predominance of materialism—is to open up the gap between the spontaneous springs of human motivation and man's conscious ideas of his duties and obligations. That which is good in its own right and should command the allegiance of people by its own authority, now finds no liveliness of response in men. At every turn it becomes necessary to use compulsion and standardized methods. Men are to be made to keep the peace by force. Education, with an increasing dependence on civics and industry, is increasingly a standardized drilling. The health of families is to be cared for by others and the parent becomes increasingly passive before the system. In search of 'full employment' workers are to be moved from place to place. So much direction and management of men is necessary that the State has to devise new organs for these purposes. It is no longer either possible or relevant to ask the local family and community to manage its own affairs. The Leader and the departmental legislator, by their conscious comprehension of the needs of the social machine, find themselves equipped to direct the behaviour of their fellows and the active participation of the governed is less and less a necessary feature of the State. While this goes on in society, the people, finding their performance more and more sharply divorced from the deeper springs of their own motivation become infected by the ambitions of their leaders; or alternatively relapse into apathy; or break themselves in impotent rebellion against the power of State compulsion.

It is no wonder if in this situation religion languishes and loses face. The faculty of religion springs out of those very qualities of the human psyche which contemporary compulsive disciplines inhibit. If the priest is to-day impotent it is largely because authority invades the realm of the internal autonomy of the person; and also because the values of materialism, and an artificial insistence on the duties which are owed to the State machine, disestablish the authority of spiritual values. That true religion which dwells among people as a true brother-

liness, and a just insight into the fundamental quality of the person, cannot flourish in a culture which has lost all understanding of the spontaneity by which man makes and utilizes his own opportunities of experience. The mere supply of opportunity is as nothing in the spiritual realm. What is all important is the motion and quality of the spirit which enables it to utilize and develop opportunities.

The social situation of modern man is already so extreme and the momentum of social change so great, that no approach from the side of government and compulsion can redeem it. The problem of society is to-day pre-political. It depends upon the release of the creative forces which are at present repressed and latent within the fundamental unit of society, to wit, the family. These are the beginnings to which sooner or later contemporary society must return in order to build anew an association which will release, and not repress, the creative powers of life and bring the indwelling potency of men into ordered balance with the greater disciplines of Nature.

It is to these problems that public knowledge should now be urgently directed. Only when men have adequate frames of public reference for the judgment of their characteristic performance and spontaneity, and only when they are able to envisage these matters in social contexts which arise out of the very nature of the constant propagation of new generations, will the present distortions of public thinking be corrected. When contemporary consciousness is extended by these means to illuminate the situation of man as a living creature within a living universe, balance can again be brought into our social living by the integration of life's many members into a unity and an integrity of which materialism of necessity knows nothing.

XI

PHYSICS AND SOCIETY

The handling of new tools and new sources of power has, in the course of the last two centuries, made good social living more and not less difficult. Although the comfort of living has become greater and in many instances the physical effort of making a living less, it is doubtful if the intensity and quality of man's experience of his culture has deepened and improved. The situation of the family as a unit in society has certainly deteriorated. And in general the task of arranging society so that men can live in it with dignity and satisfaction is of such difficulty that its urgent necessity causes our present civilization to groan and creak. Man's new knowledge of materials and his ingenuity in devising tools for their manipulation, has raised for society an issue which is new. It concerns the impact which these new manipulative skills have made upon the complex fabric of life—the soil, the vegetation which supplies the soil and which the soil supports, the inter-dependence of plant, animal and man, and the development of the human psyche as the conscious agent of the total performance of Life. When the changes which the last three centuries have seen in society are considered against the background of their effect upon man's biological endowment, we are able to measure the actual vices of social performance alongside its potential virtues. This is a matter to which I have directed attention in another book (*The Discipline of Peace*).[1] With this contrast in view we are able to see that the widening of the scope of social performance is a neutral process. It may add to the sum of our living or it may detract from it. But in order that the widening spiral of life may redound to human fullness and human wholeness—a consummation which all men must desire—the organization of society and the conventions of human behaviour must be compatible with the order and spontaneous initiative of the human soul on the one hand and the order in Nature on the other, for here is the derivation not only of society, but also of the tools and power of the modern industrial world.

It is one of the paradoxes of knowledge that when we wish to comprehend the character of the universe which furnishes the experi-

[1] *The Discipline of Peace*, K. E. Barlow (Faber and Faber).

ence of man, it is generally better to define the limitations of our present usages of learning against the dimly perceived vistas of our unformulated insight, than to try to give these vistas form and symbol by some new and specially devised means. It is the dim and hazy background of our insight which we wish to bring into the brightness of sharp understanding; yet this act of illumination, if it is to be public and socially useful, must be effected by the intellectual apparatus which is familiar and accustomed. If the machinery of public knowledge does not easily lend itself to the handling of these remote truths, nevertheless the fault lies not in their inexpressibility, but in a machinery of thought which fails to express them. Our recognition of this fault must lead us to revise, modify and extend out public knowledge; we cannot cast it away and suck new methods out of our thumbs.

The field of experience which we explore when we study biology by the methods of physics is limited. But since all knowledge and all experience is continuous, it is precisely the measurement of limited fields against the great background of that against which it is defined which illuminates our understanding. It must be evident from what has been written that when we speak of physics and biology as limited fields of knowledge, we are not describing sections or parts of the universe. By the field of knowledge we mean a system of frames of reference and it is the application of such a system to experience which is limited. There are certain aspects of our experience which we may be said to comprehend by the help of such a system of reference. And of course the frame of reference is derived from, and has upon it the impress of, the universe which is beyond and which intrudes upon knowledge. What is more, by its use in man's participation in experience, experience is itself modified and the shape and development of society are affected. Man's participation in experience is, it is to be noted, a phrase which implies social action and which includes spontaneity. Yet even unforeseen inspiration uses frames of reference as it plays its part in modifying society—if such frames are suitable for its use. The prophet comes not to destroy but to fulfil the law. This situation shows at once how important it is that public knowledge shall be of sufficient scope to accommodate the full range of inspiration, initiative and impulse—words intended to convey the inherent motion of the living thing.

When we discover that public knowledge has in fact undergone

very uneven development we foresee that unless some corrective is applied, society will also be likely to undergo a distorted development.

It is for this reason that a survey of the range and development of science and other knowledge is relevant to a study of society. In what manner and to what degree the state of public knowledge does affect public action is a complex and intricate study. Public knowledge is in a sense a neutral affair—it is a matter of frames of reference—and the whole dynamic of motive and behaviour patterns is relevant to our consideration of its use. But if we take man, sanguine but sinful as in experience he is found to be, it is seen that public knowledge tends to canalize his activity. That part of the universe on which he can get his bearings by means of public frames of reference is of easier access. This remains true despite the fact that our access is incomplete, being indeed limited by the very quality of the frames of reference by which our understanding reaches out to it: for the frame has the character of a symbol, it represents a withdrawal from the immediacy of experience to the standard, and in the withdrawal something is shed for the sake of the standard. This by itself is inevitable—not a fault. But if men mistake the usability of the standard for the indwelling truth of the universe—that is a mistake. It is a cultural error which degrades the state of man, and may develop into a shadow which stands between him and the reality of his existence. If that shadow is comprised of the standards of science, then science belittles man and disorders his society. The standards of science are for the use of men. Man was not born into association with his fellows to serve and magnify the standards which he and they create.

Let us consider how the science of physics has served to canalize the activity of man and to affect the development of his society and association. The fundamental ideas of physics, the units of which, in many forms, constitute its basic system of standards, are the notions of work (also called energy) and of the rate at which work is done (also called power). To say that the elaboration of our public knowledge of energetics in the days since Newton has immensely increased the ability of men in society to get work done is to state the obvious. The new knowledge allowed man to direct the rivers, the coal beds and eventually the electrical charges of matter, to work on his behalf and to his design. It not only allowed him to set things to work in a new way, it also gave him a new outlook upon and a new intimacy with those materials which proved satisfactory for working up. This

new type of manipulative activity proved to be both absorbing and profitable. It was something which held the attention of men to the exclusion of other matters, especially their obligation to respect the integrity and autonomy of their fellow-men. It was, for example, possible in the eighteen-fifties for a British priest to tell the British people that God had appointed them to be the workshop of the world. As a description by a historian of a temporary situation, in which the Lord in His wrath turned His face from His people, this assertion might be acceptable to-day. But as a platitude from a priest it is to-day astonishing not for what it says but for what it leaves unsaid. The manipulative world had given rise to something which was called industry and many men were both busy and diligent about it. But what they did not notice or rather what, when they noticed it, they did nothing about, was the degradation of men within industry and of communities of men by industry. The due order of society was broken into. More it would seem by a failure of understanding than by necessary consequence and design, the fields of England having been closed up in private ownership, the peasant was uprooted and pauperized and the English rural community, which had lived for a millennium, became moribund.

Although in this period the scale and character of work have undergone dramatic development, social order and manners, no longer enlivened by a just perception of human impulse, have been subject to serious disturbance. It cannot be said that the standardization of public knowledge within the field of physics was the direct and necessary cause of the shift which took place in society. But whether or no men could have lived by a deeper insight and reached a juster perception of their estate, it is evident that the development of physics and what followed from it, formed a focus for the main pressure of contemporary social endeavour. It was the absorption in, and the promise of, this manipulation of the physical—both as a virtuosity and a means of profit—which made it then seem reasonable, in a world of *laissez-faire*, to treat men and families as instruments of manufacture and not as fellow-beings. Knowledge of material opportunity and ignorance of the quality of their fellows were the equipment with which men set out to build a new industrial society.

This page of history can not only be read as a commentary on past experience, but also translated into terms of abstract principle. In so far as men in any society try to bring the whole of their experience of

the universe within the compass of a single system of frames of reference, the very character of knowledge with its recourse to the limited standard, the hypostasized symbol, requires that some of the quality of the universe will thereby be shut off from its proper influence upon their world. At any moment, of course, such a procedure is no more than the method by which the mind directs its attention to one particular phase of experience. But when this moment is drawn out, as it has been, over generations of men, then the experience of men through those generations is cramped, confined and distorted. The soul of man is then shut out by his own knowledge from experiencing the fullness of the universe.

The scientific system of the physicist came early to elaboration and has exerted its influence for some considerable time. In so far as this system has led to a misuse of knowledge, as judged by its effects upon the society of men, this is not due to any inherent fault in the scientific system itself. It is not due to imperfect experiment or inept interpretation of experiment. It occurs because one particular phase of our experience is flooded with light. We have a consistent system of bearings by which we can not only interpret the information of our senses: by integrating our actions with it, we are also able, under the guidance of what then may be described as our new knowledge of work, to alter and modify the world which surrounds us. The light which our public knowledge sheds, thus discloses a new world. The very brightness of the light, however, deepens the darkness which surrounds it. Behind the territory of physics is that of life. Here work or energy, and the rate at which it is done, cannot any longer suffice as a foundation for our science. If we enter the field of biology with all the skill and predilections of the physicist, the search after energy leads us to mark and marvel at its regulation and at the order which is established and maintained within the realms of life. This much already the science of biology has shown. But when we turn to it and, recalling that it is a realm of public knowledge, inquire whether there are or can be units or standards of order (as there are in physics, units and standards of energy), we are in a world of conceptions which have none of the elaboration and development of those of physics. It is true that we can pick out half a dozen ideas which could and, it may be, will, serve a parallel function in that science. I refer to the notions of steady states in physiology, of ecological seres, of metabolic integrations, of interdependence of organism and habitat, of characteristic develop-

ment through a life history and so on. But these notions remain uncoordinated. They give us as yet but little help in understanding the scope and quality of living performance. They are in no sense the pivots of our public frame of reference. Our framework of biological knowledge has not yet been systematized in its own right. The notion of biological order has not yet any science to illustrate it as physics illuminates the notions of physical work and energy.

If in the last century Western civilization had had adequate public knowledge of biological order, the economic doctrine of *laissez-faire* could never have earned for itself the prestige which it did in fact acquire. But unhappily we then had no such knowledge. The comments of such men as John Hunter had gone unheeded and in place of knowledge of order, biology was overrun by a bastard theory of The Survival of the Fittest. Thus as men lived together within the intruding universe not only was one aspect of their experience illuminated by their new public knowledge, but also other most significant aspects were darkened by the lack of such knowledge.

Outside the field of physics no systematized public knowledge proved adequate to disclose to men in the West which were the significant features of the intruding universe towards which they should direct their efforts and actions. Yet men were able to discern and to record what did in fact happen, for the metaphysical situation was not that these events were unknowable. But information of their occurrence made no sense. The villages of England were emptied of labour and craft. The towns were choked with new multitudes, herding under a smoky pall. Following the Speenhamland Act and the Enclosures the rural worker was pauperized and conditions of town living constituted what is now a well-known tale of horror. Whereas knowledge of physics led to the consistent development of a phase of human activity, information as to the events in society had no such effect. This was because the essential units of work and the essential materials with which men worked in this physical sphere were being recognized and brought to definition. An erg was an erg, a watt a watt and the relation of each to a horsepower was defined. The essential structures had an adequate frame of reference as a guide to them. What was present to be dealt with could by this means be identified. But in the biological and social sciences there was no comparable activity. Society, it can now be seen, had over long centuries established a certain order within itself based upon definite relations to the

soil, the control and regulation of the work of the craftsman, and certain cultural and religious professions which took shape in customs and manners. The order, such as it was, was there. But men were not publicly knowledgeable concerning it. Frames of reference of a sort it is true they had. But first the Protestant and anti-natural doctrines of Luther and Calvin and then the setting of all sin outside of man in his society by the revolutionary doctrines of Jean Jacques Rousseau had supplanted such notions of natural law as were still alive in the days of Hooker. Thus when physics began to reach a new systematization the theory of society was already oblivious of the significance of the Natural order. It is therefore correct to say that at this time there were no adequate frames of reference to direct men's recognition towards this most significant aspect of their experience. So far as society was concerned these generations did not succeed in identifying what was there to be dealt with. They acted blindly without the guidance of public knowledge. What, as a consequence, they brought to pass was neither foreseen, nor, when it happened, was it approved. Looking back over the last pages of history we begin to see with some precision what was left out of account. The dependence of man upon the rich fruits of the soil; the survival of the soil's fertility; the part played therein by plant and animal; what the neighbourliness of local life is capable of contributing to culture; and above all the principle of autonomy which makes the individual and his family the necessary seat of their own order and regulation—all this traditional insight was eroded and laid waste. The earth was no longer treated as the Good Earth, the source of health and wealth. Men had a new source of wealth in the new means and rates of work. The products of these they could send out into the four corners of the earth to be bartered for the produce which could be torn from those distant soils. The farmer and the peasant ceased to be the custodians of their own soil. The traditions of a thousand years underwent a shift, displaced from men's minds by the increase of cropping which enclosure allowed and later by interest in chemical fertilizers, and by the advantages of buying foreign food with the new manufactures. Families could no longer look to the earth for their livelihood in a society and culture which, if limited, were yet in a measure stable and ordered. As they gradually came to represent a supply service in a world of industry, their situation was no longer that of communities who were served by their own crafts, but that of dependents in a national and international system

of trade, by which they served the operatives of industrial centres with food and raw materials for their work. As this international system was extended ubiquitously by facilities of communication, the European system of agriculture was transferred by emigrants to the soils of the new world. It is one of the misfortunes of history that this agriculture was not adapted to its new home, for its wastefulness under alien conditions reinforced the worst effects of the new international trading system. These two facts together tore the fecundity out of vast stretches of new world soils. Man's lack of knowledge of biological order here produced manifest and appalling damage to his world.

The most disquieting thing about this piece of history is that the situation it produced has not altered even in this present hour. Even in 1945 we cannot claim to know, as a culture, what are the essential units and patterns of biological and social order. We still stumble blindly forward intent upon our industrial performance without attending to the cardinal issues of the organization of life, either upon its biological or its social levels, although that organization must continue to take the impact of our industrial manipulation. We still believe that work and rates of work can provide us with the answers concerning man's place in the universe. We do not take adequate stock of the pre-existing order of the universe which endows all our being. We do not study the needs of men with the same dispassionate interest which we display in our examination of the units of matter and energy. Biology has already shown that it is by internal organization and self-regulation that the spontaneous principle of life moves. But we do not seek in our society to accommodate our organization to any such principle. Even the child and the savage, when the universe first arouses their wonder, can see that their world carries within it a regularity and principle of order of some kind, and can formulate some questions about it. Yet we may search our public knowledge in vain to ascertain what our elaborate scientific culture has done to answer the most significant questions in our experience, or even to formulate them. The plain fact is that, although hourly we have to deal somehow with such questions, we have as yet not even the beginnings of an adequate public knowledge to guide this phase of our social action. The immense ocean of life is still uncharted.

In the science of biology, the examination of living things by physicists and chemists is at long last beginning to result in our

and the prospect of development which such new knowledge may be expected to give us.

If we tend to think that even such new knowledge would have to wait upon and defer to the necessities of business organization, we have not learnt either the lesson of five generations of industry or of the present war economy. It is not the character of the machine which man uses to do his work which compels us to the present set-up: it is the convention of machine organization. The question of what the machine will do for human need has never been dispassionately considered. Indeed the nature of human need is, in the scientific sense, unknown. It has been said, and it cannot be too often repeated or too strongly emphasized, that industrial organization grew up under the urge of new physical knowledge without giving heed to social organization, human need or biological order. Its doctrine of social relations was 'Let things happen'—'*Laissez-aller, laissez-faire*'. It is therefore not true that the present organization of industry has grown up in the endeavour to satisfy the needs of men. It was so ignorant of, and so indifferent to, human need that it lived for generations under the supposedly scientific slogan of The Survival of the Fittest. The drab and sordid drama of the industrial revolution played out its tedious course to that theme. It is only the other day that we saw vast international armies in the grip of grievous need. Industry abounded, but the needs of men were unsatisfied and the hands of men and the bellies of men were unemployed. In five continents the soil gaped and rotted—not the rich rot of the leaf, but the cruel erosion which marked the triumph of physical force over the organization of life. In the warm countryside the system of industry and trade did not allow the good use, not even the technical use, of the enclosed fields. It was not the machine which made all this necessary. It was the machine's use. It was the conventions of industrial organization. This was a fashion which moved in its own right because men followed it. But it could only so move because men schooled themselves to see that part only of the universe which their public frames of reference disclosed.

The industrialist is not to be looked upon as vicious in what he has done, but as ignorant. He has shared in the specific ignorance of a culture and it is not his fault that he has been the chief person to benefit from such ignorance. Only men ignorant of biological order and blind to many aspects of man's social situation in his universe

could have justified and magnified the course of manufacture and trade which has brought us social chaos and has now twice led to Armageddon. Work and rates of work have so preoccupied industrial man that social order has been neglected. The objective of the typical industrial mind is a curious type of quantitive plenty: its ideal is a plethora. To see how the product of manufacture can serve good living is no part of the industrialist's culture. Experience has shown again and again that plethora without order is an embarrassment to social life and not an endowment. The tedious repetition of trade cycles is the witness to this truth. Now we appear again to be about to found our affairs upon the assumption that if what can be made can be disposed of, the result will be a social order. The industrialist still believes that if all values except industrial values can be suppressed the world can be made fit for the pilgrimage of man. Metaphysically this is the attempt to know the universe as a complex of factory organization. The attempt is rationalized by doctrines which may almost be said to conceive God as either a physicist or a mathematician. The industrialist does not yet see that this type of thinking is in no sense a taking stock of, a co-operation with, and a development of a pre-existing order of life. He believes that by ignoring that order in its entirety he can himself endow life. He does not read the warnings of his trade cycles, of his vast conurbations, of his special areas, of his eroded soils and his dying communities. He cannot see that by his own efforts a world is being brought to ruin and a universe threatened. He believes that his warehouses stocked with machine tools and their products are the bricks of a new world and in the passionate ignorance of his beliefs he does not stop to ask whether he knows wherein the social quality of a world resides and how, if at all, a new world may be made.

It is quite certain that the industrialist does not bear the chief responsibility for all this. Our men of learning and of culture have in their hearts a profound inquietude. But they have no adequate public knowledge of what it takes to make a society. They cannot tell industry what it is after. They know little in detail of human need. They lack standards for the structure of a community. Without effective exception they leave the industrialist to flounder on towards his goal of supposed perfection in his specific technique. There is no body of culture to define for the industrialist the ends which his technique should follow. Men of learning often accept his dreams of a Work

XII

THE FACULTIES WHICH USE KNOWLEDGE

If reason is the tool of life, then frames of reference are its jigs. For the proper use of the jigs and tools of the intellect the prime essential is not the plan, which is itself derivative, but the capacity to invent, to order and to bring all within the unity of that synthesis which life is.

The ability of the living thing to bring forth unity within its own performance fits well with what is beyond and outside itself. This remains true in principle even when our experience shows that cultural synthesis fails to take place. For when any organism is diseased the principle of the disease is no negation of the principle of its health. The essential unity and order of Nature is born in upon us by our experience despite the attempt of arrogant and ambitious men to fly in the face of that unity and order. We can shut our eyes to the lessons of the instincts of insects, of the fishes, the birds and the beasts of the fields; we can ignore the delicate balance of plant and animal species; but our resolute preoccupation with materials and their manipulation does not annihilate what we choose to ignore. These instances of order would serve, if we did but observe them, to rebuke our ignorance. They would have us inquire concerning the unifying principle in human living and the way in which this principle can fit into the greater compass of Nature which embraces and begets it.

That synthesis of human life and living, which alone can properly use reason and the frames of reference which reason produces, springs out of birth and the processes of development which follow from birth; since birth and development are themselves begotten of the family, it is clear that we have in the family the cradle in which human life is nurtured. One by one the faculties and appetites of human individuals are quickened and fed by the immediate setting of the home. It is through the home that the experience of the world about it reaches the child. Here it first begins to use its senses, its posture and its power of locomotion. It is upon the estate of experience to which the family is heir that the child is bred up, its bent developed and the ordered synthesis of its being established.

Just as in the realm of public information the individual depends, not upon himself alone, but upon public frames of reference, so at that deeper level of living (at which there operates not knowledge but the faculties which live and know and which beget unity out of living): at this deeper level, the individual again depends not on himself alone, but upon his particulars, his kin. In all culture therefore we at no point come back to the primacy of individuals: everywhere the primacy and the potency of living is rooted in groups of individuals. Where the powers of life are greatest and where the essential creative synthesis of personalities resides, there the group with which we have to reckon is the family.

It is true, it is lamentably true, that the family commonly falls short of its proper achievement. Indeed it falls so far short that if we confuse the common performance of the family with its proper purpose, and judge it by the poor degree of development which in fact and in experience we perceive it to effect in the faculties and personalities of its members, then we have grounds for anger and for crying out for the destruction of all families as groupings which fail in their proper task. But such confusion and the anger to which it gives rise lead only to destruction. In health the power of awakening the faculties of men and women lies in the family and in the family alone. If we pervert our families we pervert also the faculties of our heirs. In this situation we must seek to eliminate perversion by breeding health. It is no answer but plain despair to attempt to breed out the family.

The family works through sex, but the wrong use of sex damages the family. The operations of the family have about them, when the parent's faculties are fully awakened, the certainty of instinct—as in the insect; they know nothing of the accidental, nor of trial and error which are the occasions and the modes of reason. To use sex to explore the accidental, to enter into promiscuity as two wars and much ignorance have taught our generation to do, this is to put an end to certainty, to confuse instinctive choice and eventually to build about our hearths, homes which lack the power of quickening the wits and talents of those who are to come after.

Certainty is the mode of love and fitness is its fulfilment. In engineering we speak of male and female as two complementary forms which fit well together and this analogy is well perceived. Fitness of this type is the root of marriage and when it is animated by the fertile plasticity of life it serves not simply to bring forth itself again, but also to

ledge of appetite is to be found. Hence within the family and within the members of the family digestion of experience must wait upon appetite for experience, as well as upon the awakening of those faculties which appetite serves. When appetite is established the personality can feed, and indeed that is in due season its inclination. To force feed is to spoil the appetite and to damage both digestion and health. Our knowledge and our frames of reference are properly to be understood as the foods which the lively appetite will seek out according to its taste and its need. The impulse to development in all living things comes from within. It is true that they give evidence of regulation, but it is regulation from within—autonomy, the obedience of the creature to the law of its own being. Only in disease and sickness is this state of affairs altered. Then the breakdown of self-regulation is the very character of the disease which assails the self. With remission of the disease, if health supervenes, autonomy is re-established. Good health pursues its course by the integration of the many appetites which awaken within the person and enable his faculties to digest from the realm of their experience that towards which appetite inclines them.

The family on the one part and society on the other must, each for its own health's sake, respect and furnish the many autonomies within their compass. Here and here alone is the justification of freedom. Freedom sets men free to fulfil the obligations of their own being. The free and the healthy require access to all knowledge because the bent of each differs and appetite follows bent. Without freedom and without health the faculties which alone can use knowledge and bring it within the synthesis of living cannot be awakened and brought to perfection. Until they are so awakened the provision of knowledge in all its infinity does not operate to educate life, but to sow the estates of man with the tares of disillusion.

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